

Technical Report EE 85004

A REVIEW OF PSYCHICAL RESEARCH AT
SRI AND PRINCETON UNIVERSITY

by

Douglas J. Matzke and Lorn L. Howard

Electrical Engineering Department
Southern Methodist University
Dallas, Texas 75275

ABSTRACT

During the last ten years engineering research in the psychic areas of Remote Viewing and Psychokinesis has been conducted at SRI International and at Princeton University. This paper describes the development of their research, the experimental protocols, the theoretical issues, and conclusions of their research. The final chapter addresses potential implications of this research for the engineering and technical communities.

January 1985

Table of Contents

Chapter 1 INTRODUCTION	2
Chapter 2 REMOTE VIEWING	7
2.1 HISTORY	7
2.2 EXPERIMENTAL PROTOCOL	9
2.3 SCORING AND DATA BASE	14
2.4 THEORY DISCUSSION	18
2.5 CONCLUSIONS AND COMMENTS	21
Chapter 3 PSYCHOKINESIS	23
3.1 HISTORY	23
3.2 EXPERIMENTAL PROTOCOL	26
3.3 SCORING AND DATA BASE	27
3.4 THEORY DISCUSSION	29
3.5 CONCLUSIONS AND COMMENTS	31
Chapter 4 CONCLUSIONS AND FUTURE WORK	34
Appendix A DESCRIPTOR RESPONSE QUESTIONS	41
Appendix B LIST OF REFERENCES	42

List of Figures

<u>Figure</u>		<u>Page</u>
1	Remote Viewing Trial Criteria.....	17
2	Geographical and Temporal Distance Chart..	19
3	REG Results at 200 Samples Per Second.....	28
4	REG Results at 2000 Samples Per Second....	29

Chapter 1

INTRODUCTION

This paper describes the current engineering research in Remote Viewing and Psychokinesis (PK). These two major areas of psychic research are posing new questions about the nature of information, energy, and man's consciousness. A definition of "psychic phenomena" (frequently denoted by "PSI") includes all processes of information and/or energy exchange that involve animate consciousness in a manner not currently explicable in terms of known science.¹ Let the term "psychic research" imply any scholarly study of such phenomena employing scientific methodology, rather than any theological or ritualistic approach.

For thousands of years people have been interested in psychic phenomena, but orderly and organized scholarly investigation began only a century ago with the founding of the Society of Psychical Research in London in 1882. Laboratory study began barely fifty years ago in the late 1920's at Duke University under the direction of J. B. Rhine. Many famous psychologists such as Sigmund Freud and Carl Jung have also shown a great interest in this field due to the similarities between apparent psychic experiences and certain psychological processes.

1. Robert G. Jahn, "The Persistent Paradox of Psychic Phenomena: An Engineering Perspective" Proceedings of the IEEE, Volume 70, No 2, page 139.

Remote Viewing pertains to the ability of certain individuals to access and describe, by means of mental processes, information sources blocked from ordinary perception (for example by shielding or distance) and believed to be secure against such access.² In particular, the investigations have concentrated on the individual's ability to perceive remote geographical locations up to several thousand kilometers as well as temporally remote locations up to 30 hours in the future (usually referred to as Precognition). This phenomena of information transmission under ordinary sensory shielding is not comprehended by our current understanding of communication theory or other physical laws.

Psychokinesis (PK) refers to a detectable influence of consciousness on a physical or biological system.³ This interaction may be spontaneous or deliberate; and the energy transfer involved may range from a microscopic disturbance of atomic-level processes, through macroscopic distortion or levitation of objects. The influence of the mind on the healing processes, as in the case of Psychic Healing, is an example of PK in biological systems.

Historically, objective psychic research has been plagued with obstacles. Certainly no field of scholarly endeavor has proven more difficult and frustrating, nor has been more abused and misunderstood, than that of psychic phenomena. Due to the confusion between PSI and occultism many people have strong emotions about psychic phenomena. It is obvious that a highly emotion-laden subject presents problems to objective scientific study. Some critics have stated they won't believe in PSI even if

2. Harold E. Puthoff and Russell Targ, "Direct Perception of Remote Geographical Locations" Electro/77 Special Session on the State of the Art in Psychic Research, page 1.

3. Jahn, "Psychic Phenomena: Engineering Perspective", page 139.

it could be proven that it existed. Fear of the unknown has also limited serious research in PSI.

Trying to meet strict scientific experimental standards has also posed a problem because historically most psychic experiences have been spontaneous. The lack of well controlled experiments that were repeatable on demand allowed early critics to speculate "normal causes" or "coincidence" as an explanation for apparent psychic occurrences. The best experiments to date indicate that PSI exists because the results have been shown to be "statistically significant". The psychic field is still in the observation stage of research with no hard proof of existence currently available.

Another major limitation to progress in psychic research is the lack of a theory based upon known scientific laws and principles. This has slowed the normal scientific process of hypothesis, experiments, and proof. A theory is critically important in order to design controls for experimental variables. In addition, a useful mathematical theory would allow the prediction of quantifiable results.

During the last ten years, significant research was conducted in the area of Remote Viewing at Stanford Research International (SRI), under the direction of Russell Targ and Harold Puthoff. During the last five years, the Dean of Engineering Robert G. Jahn, at the Princeton Engineering Anomalies Research Laboratory of Princeton University, has duplicated SRI's remote viewing experiments and has conducted additional research in psychokinesis. These laboratories have developed the research protocol for Remote Viewing and Psychokinesis sufficiently to demonstrate repeatable, statistically significant experiments that strongly indicate the existence of these phenomena.

These laboratories as well as Duke University in Durham, North

Carolina, Mind Science Foundation in San Antonio, Texas, and many others around the world have been slowly solving some of the problems associated with psychic research. All of these reputable research laboratories have acquired funding to do basic research in PSI from many organizations including the Institute of Noetic Sciences, founded by ex-astronaut Edgar Mitchell and the McDonnell Foundation, Inc. In addition, modern precise definitions of terms have helped to remove the emotional baggage associated with occult names. Recasting the PSI problem statements into quantifiable engineering questions has allowed the proposal of abstract theories closely resembling those of quantum physics. Large computer data bases of laboratory-acquired, experimental data have been collected from PSI experiments, and substantial statistical analysis of these data has been performed to detect and to remove any procedural biases.

Psychic research and its subsequent understanding would appear to be important to the technical communities. Psychologists may be able to find more quantifiable laws of the mind. Physicists may be able to pose new questions about matter and energy that are the basis of the laws of physics. Computer engineers and other information theorists may reach new insight into the physics of computation and intelligence by analyzing the communications channels apparent in psychic phenomena. Currently, none of these professional groups is singularly qualified to make the breakthrough necessary to turn PSI from a research interest into a technology. It may require all of these kinds of professionals to solve this interdisciplinary challenge.

The purpose of this paper is to review and appraise the research at SRI and Princeton in Remote Viewing and Psychokinesis. Chapter 2 will discuss the Remote Viewing research at both SRI and Princeton, and Chapter 3 will describe the PK work at Princeton. Each of these chapters will describe the history of the research

with an emphasis on the evolution of the protocols. The actual protocols will be described in detail because these protocols are the foundation for the validity of the research. The establishment of this validity is probably the most important development in the history of research in these areas. This development has come about as control of some the variables has been achieved. Each chapter will also include a section describing the data bases and analysis techniques. Research conclusions from the literature, and the author's comments on the work will conclude each chapter. The last chapter will describe where the research is headed and the prospects and implications for success.

Chapter 2

REMOTE VIEWING

2.1 HISTORY

In 1972 the term "Remote Viewing" was adopted to describe the ability of a person to acquire information about a remote location under the conditions of sensory shielding.⁴ "Remote Sensing"⁵ and "Remote Perception"⁶ have also been cited in the literature as names for this phenomenon. This relatively neutral term was adopted for this capability in order to remove any stigma surrounding the use of other terms and to avoid any prejudgement about the workings of psychic functioning. Due to work with a gifted psychic named Igno Swann,⁷ Remote Viewing was initially thought of as the ability to access information only from remote geographical locations. Later experiments with another subject named Pat Price, indicated that viewing of temporal distances was also possible.⁸ Since 1978 Princeton University has performed over 300 Remote Viewing trials and collected the results into a -----

4. Russell Targ and Keith Harary, The Mind Race, page 14.

5. Puthoff, "Direct Perception of Remote Geographical Locations", Page 1.

6. Jahn, "Psychic Phenomena: Engineering Perspective", page 150.

7. Russell Targ and Harold Puthoff, Mind Reach, Pages 26-30.

8. Targ, Mind Race, page 57.

computer data base. Most of these trials were performed with both spacial and temporal distances from the perspective of the laboratory viewer.⁹

In 1972, Puthoff, Targ and Swann were working on the remote perception of information using the "hidden-object-in-a-box" protocols.¹⁰ Researchers of the day knew that this type of experiment was very repetitive and boring and had suggested that the "decline effect" of psychic experiments may be caused by this boredom. (The decline effect is the apparent loss of good scores during the middle of a series of ExtraSensory Perception (ESP) experiments, with better scores near the beginning and the end of a trial set.) One day Swann suggested that the researchers try specifying an arbitrary latitude and longitude as a target location from which to acquire information. He would then try to describe what structures (natural or man-made) were at that location. Subsequent experiments with this quite unlikely protocol showed good results and easy verification of major landmarks such as a city, lake, or mountain. These early experiments indicated that a person could "home in" on some location even using an abstract coordinate system such as longitude and latitude.

The idea of accessing remote geographical locations led SRI investigators away from the more traditional card-and-picture ESP experiments, towards the development of a Remote Viewing protocol. This new protocol deviated from the longitude and latitude experiments because a person was utilized as the target. This person, known as an agent, would open one of ten sealed envelopes and would proceed to the secret location described

9. Brenda J. Dunne, Robert G. Jahn, and Roger D. Nelson, "Precognitive Remote Perception", Technical Note Princeton Engineering Anomalies Research 83003, page 4.

10. Targ, Mind Reach, page 26.

therein by a specified time. The agent's presence at a location could be thought of as an abstract marker of the desired site, which was unknown to everyone involved with the experiment but himself.

During another experiment in 1974 Pat Price made an important new discovery. Pat and the experimenter were waiting for the agent to arrive at the target site when Pat indicated it wasn't necessary to wait, and then proceeded to describe where the agent was going to be.¹¹ This became a landmark discovery because Pat described the location before the agent had actually picked the location from his pool of 10 possible targets.

2.2 EXPERIMENTAL PROTOCOL

When trying to appraise the validity of Remote-Viewing research it is critical to understand the detailed experimental protocol. Since the experimental protocol for psychic research is subject to much tougher standards than for other fields, great efforts have been made to disallow outright cheating by the viewer or subtle cueing of the viewer by the experimenters. The final protocol evolved over many experiments and viewers. From the time of the earliest trials, SRI scientists have paid close attention to the subtle impressions and observations of the viewers in order to learn as much as possible about the Remote Viewing process, and in order to make the trials more reliable and repeatable.

The SRI Remote Viewing target locations were preselected by someone who was not directly involved with the experiments. The

11. Targ, Mind Race, page 57

criteria for choosing target locations were that they be distinctive and that they could be reached within a half hour's drive from the laboratory. The location of each target was then sealed in an individually numbered envelope; and for each trial, 10 of the 100 target envelopes were picked at random to travel with the agent.

At approximately one-half hour before the scheduled arrival time at the target site, the agent would stop his or her vehicle and, using a random-number generator, would pick one of the ten envelopes, open it, and proceed to the destination described therein. This target pool preparation made it practically impossible for the viewer and experimenters at the laboratory to know the target location at any time. This also allowed complete freedom of the experimenters to coach the viewer into paying attention to the fleeting images he or she was trying to perceive.

Early SRI experiments were conducted in a double-walled, copper-screened room known as a Faraday cage.¹² The purpose of this was two-fold: first, to prevent most types of electromagnetic energy from reaching the viewer, and thus to eliminate that as a possible source of the information; and second, to silence the critics in advance about possible cheating by professional psychics using sophisticated electronics. Even under the constraints of being in this special room the atmosphere was relaxed and friendly.

After the agent had left the lab with the sealed envelopes, the viewer and experimenters went into the room, sat in comfortable chairs, and relaxed. At the appointed time, the viewer would write down whatever impressions came into his mind. The

12. Targ, Mind Reach, page 54.

experimenter would coach the viewer to draw pictures and get feelings about the place without trying to put labels on them. The session's entire conversation was tape recorded.

The information obtained by the viewer during a Remote Viewing session would usually come as fleeting images rather than as strong pictures. These fleeting images would usually be so vague that they would have to be described as shapes, colors, and feelings. Based on experience, most strong images were usually not about the target scene at all, but rather were "noise" invented in the mind of the viewer. After the appointed time, the viewer would return to the lab and turn in the descriptions and photographs of the scene he had just visited. The agent's and viewer's transcripts were separately organized for analysis later by a panel of judges.

Immediately after the session, the viewer would be taken to the target site for immediate feedback about the session. The quick feedback was found to be important because of the apparent learning process that viewers go through. Due to the culturally based impression of the impossibility of Remote Viewing, a lot of positive re-enforcement was given to the viewers. Quick feedback about individual successes and group support about the the reality of the entire Remote Viewing process kept the enthusiasm high and improved learning. As the learning process continued, no doubts remained in the minds of the most advanced participants, because the fleeting images were replaced by strong feelings, smells, colors and textures from the remote scenes. Complete descriptions and drawings of specific trials are given in the references.¹³

13. Targ, Mind Reach, Pages 74-102.

A very interesting but not absolutely essential aspect of the protocol was the use of an agent to help specify or isolate a remote location. An agent was also useful to document transient activities at the site. The researchers also discovered that using the agent produced some interesting results. Moving agents were generally hard to "track" during a session.¹⁴ In order to make the agent a poor target until he reached the target site, the agent drove around in an automobile for a half hour before arriving at the site. This made the target location and not the travel time, more easy to perceive.

Remote Viewing that spans both geographical and temporal distances is defined as Precognitive Remote Viewing. The only procedural change from the normal protocol for Precognitive Remote Viewing is that the viewing time is any period of time up to 24 hours before the time of the target site selection and visitation. Most of the Precognitive Remote Viewing trials at Princeton had a time advance of between 30 and 60 minutes. Retrocognitive Remote Viewing is defined as describing the target site after the agent had visited the target site. This protocol assumes the target location is kept a secret until after the viewing session. The viewing time for Retrocognitive Remote Viewing ranged from 24 hours to 30 minutes after the site was visited by an agent.

Objects as well as geographical targets can be utilized as targets for Remote Viewing. A series of double-blind experiments run at SRI using objects sealed in film canisters demonstrated that size of the object has no measurable impact on Remote Viewing scores.¹⁵ In fact, subsequent double-blind trials with pictures

14. Targ, Mind Reach, Page 112.

15. Targ, Mind Race, Pages 89-90.

reduced to microdots showed that even objects too small to be seen with the naked eye were perceived at a distance. ¹⁶

Based on personal phone conversations with Russell Targ and Charles Tart, SRI is currently investigating another version of Remote Viewing, Associative Remote Viewing. It is based upon precognitively perceiving an object or picture rather than geographical targets. The purpose of Associative Remote Viewing is to guess one of a limited number of outcomes for a particular future event. If five possible outcomes are possible, then five distinct targets are collected into a target pool. These targets, which are kept secret from the viewer, are then sealed into containers and one container is associated with each of the possible outcomes. The viewer then tries to describe the object that will be shown to him in the future. After the event has occurred, the corresponding object will be shown to the viewer. Since all the targets are known in advance, a high degree of feedback is possible about the reliability of the viewing information. This procedure has been successful in predicting the

outcome of horse races and silver's futures, ¹⁷ but no hard statistics of any kind has been presented in the literature. Russell Targ has started a company called "Delphi Associates" which is trying to use Associative Remote Viewing in order to earn money, but no details are available at this time.

16. Targ, Mind Race, Pages 92-93.

17. Targ, Mind Race, Pages 96-99.

2.3 SCORING AND DATA BASE

Scoring of Remote Viewing experiments was sometimes very easy because the viewer would identify the location by name. In general, most scenes were not directly identifiable, but a strong flavor of the place was evident in the transcripts and drawings of the viewer. A quantitative method was used to score all the trials at SRI. The viewer's transcript and a description of each of the 10 possible locations for that day were given to a panel for blind judging. Using a ranking of 1 to 10, the judges would rank the 10 target sites. The actual site description which best matched the viewer's description would be ranked as number 1, and the site which least resembled the viewer's description would be ranked as number 10.

Sixty to eighty percent of the time, the actual location was ranked as number 1 or number 2. This was primarily due to the flavor of the scene coming through (i.e. near an ocean, or lots of children, etc). A first- or second-place rank should have happened only 1 out of every 10 times at worst or 1 out of every 5 times at best (for both first and second). The results of blind judging were statistically significant for the SRI experiments.¹⁸ The results of the numerically ranked judging demonstrated statistically that information was being perceived from the remote site. The comparison of the drawings with photographs of the remote scenes taken from particular vantage points also strongly indicated that a transfer of information from the remote site had occurred.

¹⁸. Puthoff, "Direct Perception of Remote Geographical Locations", page 3.

The SRI protocol and judging procedures were sufficient to allow replication of Remote Viewing at other research laboratories and to provide a real cornerstone for further work; however due to the limitation of a subjective judging procedure, the data could not be easily manipulated by a computer for further evaluation. In 1978 Princeton Engineering Anomalies Research Laboratory at Princeton University started duplicating the SRI Remote Viewing trials while developing their own procedure and scoring system. The raw results of their 300 Remote Viewing trials resulted in the formation of a computer data base. A large percentage of these trials were in the precognitive mode.¹⁹ Princeton utilized mostly "regular people" who had no previous experience in "psychic work" nor had they had psychic experiences of any kind. A description of Princeton's protocol warrants further discussion because of their improvements in the classification of trials over the conditions imposed by SRI.

Six criteria for classifying trials were specified in order to be more strict about the experimental protocol. These six criteria listed in category A form the five separate categories of trials shown in Fig. 1. The Descriptor Response Form mentioned in criterion 4 of Fig. 1 was developed at Princeton to aid in their computer analysis of a large number of trials in a data base. Some of the trials were completed before this scoring form was developed and are so indicated in the data base. The Descriptor Response Form is a set of thirty "yes" and "no" questions that help describe the scene, and that are listed in Appendix A.

A significant amount of work went into assuring the validity of the data base by utilizing alternate scoring recipes and by analyzing the validity of the questions themselves.²⁰

19. Dunne, "Precognitive Remote Perception", page 4.

20. Dunne, "Precognitive Remote Perception", pages 9-12.

A. FORMAL TRIALS

1. Agent and viewer are specified to each other.
2. Date and time of the target visitation are specified to the viewer.
3. The agent must arrive at the target site within fifteen minutes of the specified time and be consciously committed to the experimental role.
4. The viewer produces a description and completes a descriptor response form.
5. Both agent and viewer have had adequate training about the general protocol and the interpretation of the descriptor-response form questions.
6. Descriptions, photographs or other substantiating target information are available.

- B. QUESTIONABLE TRIALS -meet criteria 1-4, but fail 5 or 6.
- C. INVALID TRIALS -fails to meet criteria 1-4.
- D. EXPLORATORY TRIALS -prespecified trial which fails 1-6.
- E. PRACTICE TRIALS -Used for training, not in data base

Fig. 1 Remote Viewing Trial Criteria

The descriptor answers for each trial can be stored as a 30-bit ordinal number in the computer. These data from all trials were utilized by a large number of different scoring and normalization recipes to determine what impact the scoring itself might have on the statistical results of the Remote Viewing. From the many scoring recipes explored, five representative scoring recipes were

described in the literature.²¹ The statistical merit computed for the complete Remote Viewing data base was insensitive to the particular scoring recipe employed. The traditional descriptions and drawings have also correlated with the results generated by the more objective scoring produced by the questionnaire.

Trials taken before the questionnaire was developed were treated specially and a Descriptor Response Form was generated for each trial by a set of five judges using the original transcripts. Several cross-correlation studies about the ex post facto encoded data showed no significant loss of information or insertion of error into the data base. Again, all final statistics were computed with and without those old trials, known as the ab initio

subset, with no appreciable changes in the total scores.²²

The data base also included information about the distance and time displacement between the agent visiting the site and the viewer trying to perceive that site. The geographical distance was recorded in miles and the temporal distance was recorded in hours and minutes. Time and distance data for each trial can be plotted on the chart in Fig. 2.

21. Dunne, "Precognitive Remote Perception", pages 12-13, 104-108.

22. Dunne, "Precognitive Remote Perception", pages 17-18.

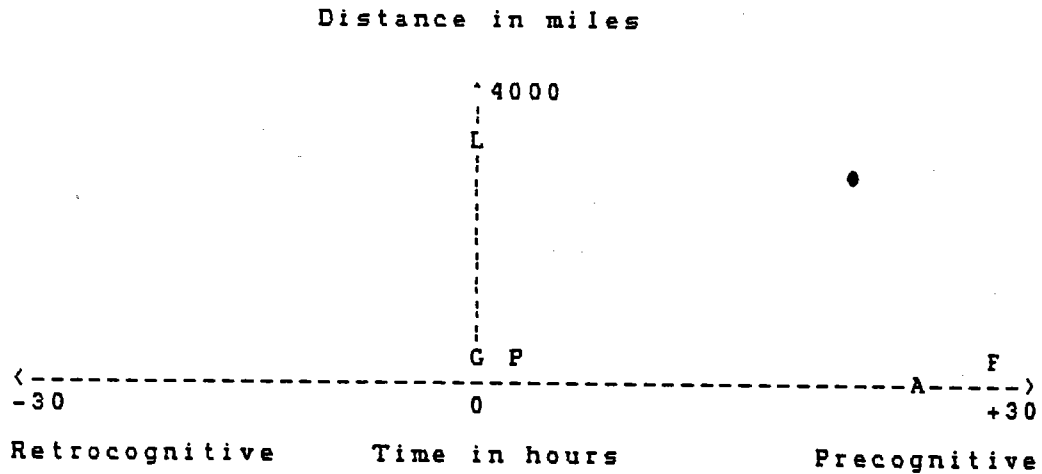


Fig. 2. Geographical and Temporal Distance Chart

Most of the "Geographical only" Remote Viewing trials would be marked by the point "G" and most of the Precognitive Remote Viewing would be marked by the point "P". Long distance trials would be marked by the point "L", meaning "Long Distance". "Next day" Precognitive Remote Viewing would generally be some distance away but up to 30 hours in the future, as marked by points "F", for "Future". Associative Remote Viewing, as marked by point "A", could have a net spacial distance of zero due to the viewing of pictures or objects at some future time with no geographical distance.

2.4 THEORY DISCUSSION

Early experiments in Remote Viewing utilized a Faraday cage to determine the possibility of electromagnetic encoding of information during the trials. Since the cage had no apparent impact on the results, an early proposal suggested that Extremely Low-Frequency (ELF) electromagnetic waves could still be a

possibility because Faraday cages cause little attenuation to ELF. Subsequent trials in a submarine submerged in several hundred feet of salt water ruled out that possibility due to the very poor transmission of ELF through salt water.²³ SRI's early work intended to eliminate obvious theoretical considerations, and no formal theoretical work has been published.

To date no satisfactory physical theory has been formalized as the mechanism for Remote Viewing.²⁴ Theoretical work is currently being investigated in the areas of Information Theory and Quantum Mechanics. The reason for a theoretical model to include information theory is obvious, but an explanation is necessary to understand what role quantum mechanics may play in the theoretical domain for Remote Viewing.

Einstein stated that no information can travel faster than the speed of light. This assumption plus the fact that some atomic interactions form "two-particle systems" has led to a paradox. Quantum theory predicts that certain two-particle systems produce particles where each particle has the opposite spin due to the conservation of spin. This implies that if either particles' spin is known then both are known instantly. The Uncertainty Principle states that these spins will not be known until they are actually measured and the outcome of the spin measurement can be influenced by the type of measurement. These facts produce a conflict if those two particles are traveling away from each other with a velocity near the speed of light. The information about one particle's spin being determined by some measurement will have to travel faster than the speed of light to catch up with the second particle.

23. Targ, Mind Race, pages 46-50.

24. Jahn, "Psychic Phenomena: Engineering Perspective", page 156.

Einstein originally proposed this thought experiment with his colleagues, Boris Podolsky and Nathan Rosen in 1935.²⁵ They predicted that only local causes would determine the spin of the second particle and not give the results predicted by quantum mechanics. Their prediction about this thought experiment was proved wrong by experiments with two-particle systems and this strongly indicated a faster-than-light information transfer. This thought experiment was originally known as the EPR (for Einstein, Podolsky and Rosen) Paradox until in 1964 a physicist named J. S. Bell developed a mathematical proof that demolished the principle of local causes and has since been known as Bell's theorem.²⁶

Theoretical models being developed at Princeton predict that consciousness might behave like a quantum mechanical wave acquiring information from a distant point in space or time via mechanisms similar to tunneling in semiconductor materials. Tunneling is the ability of electrons to pass through "potential barriers", where the height of the barrier is inversely proportional to the probability of crossing the barrier. Likewise, Psychic information may "tunnel" through the space and time barriers. It appears that SRI is working on Information Theory based models of Remote and Associative Remote Viewing.²⁷

25. Richard Grigonis, "Sixth Generation Computers", Dr. Dobbs Journal, May 1984, page 41-42.

26. J. S. Bell, "On the problems of Hidden Variables in Quantum Mechanics", Review of Modern Physics, Volume 38.

27. Based on conversation with Harold Puthoff's wife, May 30, 1984, San Francisco, CA

2.5 CONCLUSIONS AND COMMENTS

The amount of work accomplished and the results obtained in Remote-Viewing research during the last decade have been encouraging. The published results are still quite conservative in their statement of accomplishments due to the fact that these phenomena are not reproducible upon demand. Since any particular trial may not produce ideal results it is apparent that some uncontrolled variables still remain.

An important conclusion from these experiments is that: "Precognitive Remote Viewing can acquire statistically significant amounts of compounded information about spatially and temporally remote target locations, by means currently inexplicable by known physical mechanisms".²⁸ The anomalous information acquisition is actually collected in large computer data bases and the statistical significance of the anomalous information acquisition grows with the size of the data base.²⁹ Single trials produced a probability of between 1 in ten (0.1) to 1 in 100 (0.01) of that score occurring by chance. The probability that the results of the 227 formal trials in the data base would occur by chance is 1 in 10¹¹ (100,000,000,000) by any scoring method utilized.³⁰

28. Dunne, "Precognitive Remote Perception", Page 22.

29. Dunne, "Precognitive Remote Perception", Page 20.

30. Dunne, "Precognitive Remote Perception", Page 21.

Neither spatial nor temporal distances deteriorate the information transmission and perception.³¹ Data bases on the order of 3000 trials,³² that control more variables, will be needed to further evaluate the impact of spatial and temporal parameters. Preparing such a large target pool and implementing the trials while maintaining experimental formality would be a burden on the individual operators and agents.

The use of a descriptor response form produced data that allowed quite complicated computer analysis. This analysis removed all biases from the data and scoring methods themselves by comparing the results of different scoring mechanisms.

In the author's opinion, these experiments demonstrate that it is possible to directly perceive information from distant locations in space and time under the conditions of sensory shielding. It also seems reasonable to expect that "theoretical explication of psychic phenomena is not likely to be achieved in terms of known physical processes".³³ This conclusion is realistic because no form of energy known to man can travel through time. Also, the known forms of energy all demonstrate a reduction of strength with the square of the distance from their source, unlike the behavior of the information transfer during long distance Remote Viewing. A "new" form of information transfer that is not blocked by shielding is very intriguing and could be technologically useful. These simply stated conclusions have revolutionary implications.

31. Dunne, "Precognitive Remote Perception", Page 21.

32. Dunne, "Precognitive Remote Perception", Page 22.

33. Robert G. Jahn and Brenda J. Dunne, "On the Quantum Mechanics of Consciousness, with Application to Anomalous Phenomena" Technical Note Princeton Engineering Anomalies Research 83005.1, Page i.

Chapter 3

PSYCHOKINESIS

3.1 HISTORY

Psychokinesis or PK is the ability of man to influence the world directly with his mind. PK has been studied for many years, with the early experiments concentrating on trying to influence the fall of dice, rolling balls, photographic film, plants, enzymes, electronic circuits, and radioactive particles. Influencing random phenomena has proven easier than influencing other types of phenomena. A strong reason for utilizing random events is they are well known statistically. Deviation from a random statistical response can be well documented and the odds can be calculated about the probability of this happening by chance. Newly designed ultra-sensitive devices are allowing the investigation of PK influence over other than random phenomena.

34

A German physicist, Helmut Schmidt, was the first to experiment with electronic PK machines. His Random Number Generator used the radioactive isotope Strontium 90. Using a device similar to a Geiger counter, the detection of particles from the radioactive decay was designed to stop a free-running binary clock. Subjects

35

34. Jahn, "Psychic Phenomena: Engineering Perspective", pages 142-143.

35. Norma Bowles and Fran Hynds, PSI Search, page 35.

would try to influence the number of ones or zeros generated by the device. The feedback consisted of one light lit in a ring of 10 lights. Getting a "one" would cause the next light counterclockwise to turn on and a "zero" would cause the next clockwise light to turn on. By getting all of one type (0 or 1), the lights would appear to rotate either clockwise or counterclockwise respectively. Test results he obtained exceeded what would be expected by chance by odds of over 10,000 to 1. Other researchers have had success with generators of this type.³⁶

The Princeton Engineering Anomalies Research (PEAR) Laboratory of Princeton University has designed and built several PK experiments. Those that fall into the category of Ultra-Sensitive Devices include a Fabry-Perot optical interferometer, a dual-thermistor bridge and a photoelastic strain detector.³⁷ Their Fabry-Perot optical interferometer can measure changes in the separation between two plates as small as 0.1 the wavelength of visible light by producing a circular fringe light pattern that migrates radially with changes in the plate separation. Initial trials and more formal trials have produced fractional-fringe movement with a number of different operators.³⁸ The dual-thermistor bridge isolated in twin sealed pyrex flasks, can measure differences in temperature as small as 0.001 Kelvin. The photoelastic strain gauge was designed to monitor the strain in a solid specimen but to date no calibrated sensitivity has been reported. All of these ultra-sensitive devices are different attempts to find mechanisms susceptible to PK, but to date very little data have been formally published.

36. Bowles, PSI Search, page 35.

37. Jahn, "Psychic Phenomena: Engineering Perspective", pages 142-143.

38. Jahn, "Psychic Phenomena: Engineering Perspective", pages 142.

Random Physical Processes is the name for a second category of PK experiments at Princeton.³⁹ These include a mechanical cascade which is a collection of 10000 spheres that are dropped through an array of pegs to be collected in 19 bins, while photodetectors at the bin entrances count the balls. Another experiment uses small spheres bouncing on an optically flat, precisely horizontal circular plate of glass, driven by a vibration coil. These spheres bounce to the outside in a random direction in baseline conditions, but during a trial a desired direction of motion becomes the goal. In yet another experiment, a large glow-discharge device has been constructed that produces striations of light in the tube depending on current-carrying electrons interacting with the background gas. Movement of the striations up or down the tube is the goal for this experiment. Other atomic level random PK devices are also being built, some using electronic semiconductor devices as the target.

The largest PK data base at Princeton was obtained from an electronic Random Event Generator (REG). The source of the random signal was a commercial solid-state junction noise source and precision amplifier made by Elgenco. This signal was filtered, amplified, clipped, sampled, and selected to provide a one or a zero. The sample-rate adjustment ranged from 1, 10, 100, 1000, or 10,000 samples per second. Each trial could be adjusted to contain 100, 200, or 2000 samples independent of the sample-rate adjustment. A mode switch allowed counting of only positive pulses, only negative pulses, or alternating positive and negative pulses every other sample.

The remainder of this chapter will concentrate on the data obtained using this REG. The literature indicates that during a

39. Jahn, "Psychic Phenomena: Engineering Perspective", pages 143-145.

five-year period, 40 operators had compounded roughly 700,000 trials, representing over 1 billion binary bits of information.⁴⁰ These data have been compiled into a large computer data base. All of the detailed results presented in this chapter were generated by one operator in 50,000 trials.⁴¹

3.2 EXPERIMENTAL PROTOCOL

A typical operator would perform each run by sitting in front of the REG device with the start switch in his hand and looking at the device readouts. Each run of fifty trials was triggered by the start button. The REG would run automatically while the operator tried to influence it in the predetermined direction. A computer automatically tabulated and scored the results. The published results indicated no controls over what strategy the operator should adopt to achieve results. Many of the operators seemed to associate their successful performances with some sense of "resonance" with the REG device leading to a state of immersion and a loss of awareness of self. This passive-relaxed interaction was an attempt to "cooperate" with the "anthropomorphic" nature of the device rather than trying to "control" it.⁴²

One of the major concerns about this type of experiment is the

40. Jahn, "Quantum Mechanics of Consciousness", page 87.

41. Brenda J. Dunne, Robert G. Jahn, and Roger D. Nelson, "An REG Experiment With Large Data-Base Capability, II: Effects of Sample size and Various Operators", Technical Note Princeton Engineering Anomalies Research 82001, pages 5,9.

42. Roger D. Nelson, Brenda J. Dunne, and Robert G. Jahn, "An REG Experiment With Large Data-Base Capability, III: Operator Related Anomalies", Technical Note Princeton Engineering Anomalies Research 84003, pages 30-31.

reliability of the equipment. One very important part of the experimental protocol is the establishment of good baseline data. The Princeton group took special care by using computers and automating the process. This produced good reliable baseline data. The 23,000 baseline trials were run with no intentional operator influence, and they were interspersed before, during, and after the operator runs. Including the position of the operator, everything was the same as during baseline conditions, except for the intention to influence the device. The overall mean of the baseline data was 100.045 with a standard deviation of 6.980 compared to 100.000 and 7.071 predicted by the theoretical Gaussian distribution.

3.3 SCORING AND DATA BASE

The results for the first set of 25,000 trials produced the results shown in Fig. 3. The settings on the REG were 200 samples per trial at either 100 or 1000 counts per second. All of the samples were taken in the alternating mode to minimize the effect of any drift in the REG.

<u>Description</u>	<u>Mean</u>	<u>Std Dev</u>	<u>Probability</u>	<u># of trials</u>
Theoretical	100.000	7.071	1.0	none
Baseline	100.045	6.980	1.6×10^{-1}	23000
PK+	100.230	6.979	1.0×10^{-4}	13050
PK-	99.704	6.968	2.0×10^{-6}	12100
PK delta			3.0×10^{-9}	25150

Fig. 3. REG Results at 200 samples per second

The PK+ indicates the direction of effort was in the + direction whereas the PK- indicates the direction of effort was in the - direction. PK delta is the equivalent of the combined "direction-of-effort" from a statistical point of view. When these results are plotted showing the cumulative deviation, most data lie outside the 5-percent confidence levels, while the baseline data basically hover around the line predicted by chance.

The conclusions for the first 25,000 trials indicate a change rate of 1-1.5 bits per thousand from that expected by chance. This gives a per-trial change rate of 0.2 to 0.3 for 200 bits. The baseline data indicate stable equipment operation during the trial periods.

A second set of 25,000 trials in Fig. 4, was performed by the same operator as the first set. The only difference was that 2000 samples per trial was selected rather than 200, and the 1000 samples per second was selected rather than the 100 or 1000 in order to speed up data collection. The first series took 18 months to complete and the second series took only 6 months to complete.

<u>Description</u>	<u>Mean</u>	<u>Stnd Dev</u>	<u>Probability</u>	<u># of trials</u>
Theoretical	1000.000	7.071	1.0	none
Baseline	1000.016	21.879	4.7×10^{-1}	12500
PK+	1000.380	21.906	2.8×10^{-2}	12200
PK-	0999.569	22.005	1.3×10^{-2}	12800
PK delta			2.0×10^{-3}	25000

Fig. 4. REG Results at 2000 samples per second

The bits changed per thousand bits dropped off by a factor of

six to 0.2 bits per 1000. Surprisingly though, the bits changed per trial went up by a factor of 1.7, producing 0.34 to 0.51 bits changed per trial.

3.4 THEORY DISCUSSION

Princeton theorized that either the bits-per-trial or the bits-per-thousand might provide some quantitative measure of PK performance. The mechanism for influencing REG or any PK experiment is still not understood by any means. Informal quantum mechanical models from Princeton suggest that the mind may interact with other systems via a mechanism similar to quantum mechanical tunneling.⁴³

Quantum mechanics, based on the Schrodinger equation, produces a probability function dependent on variables such as mass, energy, location, and time. Theoretical work from Princeton suggests that the mind may be able to influence something fundamental to a wide variety of random processes thus changing the corresponding probability function description of that particle, resulting in a change in the physically observable quantities such as energy or location. Jahn and Dunne believe that this can be accomplished by representing consciousness itself by a quantum mechanical wave

function.⁴⁴ Their theory is in essence a substitution of new variables for x and t (location and time) where the new variables

are "consciousness metrics"⁴⁵ or standards of measurement for

43. Jahn, "Quantum Mechanics of Consciousness", page 27.

44. Jahn, "Quantum Mechanics of Consciousness", pages 25-30.

45. Jahn, "Quantum Mechanics of Consciousness", pages 62-69.

distance and time in "consciousness space". Corresponding energy and momentum values can be computed using the new consciousness coordinate system to predict penetration of potential barriers via tunneling mechanisms, and other useful psychological and parapsychological analogies.⁴⁶ The description of their theory is very detailed but they admit in the paper's foreword, that the theory is not rigorous analytically so no more time will be spent here describing the details of their work.

Other theories have been based on experiments designed to monitor "Non-intentional or spontaneous PSI". These experiments strongly support the idea that participants unconsciously acquire concealed information from the environment without them even being told that PSI was being studied.⁴⁷ The non-intentional PSI theory proposed by Rex Stanford concludes that PSI is utilized unconsciously daily to gather crucial information needed to meet each of our goals. If this idea encompasses PK activity as well, then everyday activity and "lucky coincidences" may be influenced by PSI functioning.

Non-intentional PSI becomes even more intriguing if the mind and brain are viewed as separate.⁴⁸ Charles Tart and others have proposed that the mind may actually use PK to influence the brain, which they assume to be distinct from the mind. What makes laboratory PK unusual with this perspective, is that PK experiments are an attempt to control something outside the brain rather than within the brain.

46. Jahn, "Quantum Mechanics of Consciousness", pages 25-62.

47. Benjamin B. Wolman, Handbook of Parapsychology, pages 841-850.

48. Private communication July 12, 1984

3.5 CONCLUSIONS AND COMMENTS

The major conclusion about psychokinesis is that the amount of measured change is rather small, seldom more than 1 bit in out of a thousand. The change due to PK in REG experiments appears as a small shift in the mean of the statistical response. This deviation from the theoretical chance values is small enough that no direct significance can be attached to this change unless it is compounded statistically by a large number of trials. When the accumulated deviations are plotted versus the number of trials, a characteristic "signature" for each operator emerges. These signatures seem to be strongly device-specific.

The literature indicates that in order for PK to occur, some change must occur in the device-under-influence. It is assumed that this change is accomplished by some form of energy transfer.⁴⁹ If each experiment is designed for a specific kind of energy interaction, then a classification of the kind of energy that is most conducive to mental influence may emerge. Early dice experiments indicated that the random devices were more susceptible to PK influence than more deterministic devices. Influencing the probability of some event occurring seems to be equivalent to what Einstein called "playing with dice". Currently it is not clear what relationship exists between randomness or probability and the effective energy, if any, presumed to be needed to cause a change in the probability functions.

Communication theory states that messages have entropy, which is a measure of the amount of order and/or energy in a system. Reordering a system requires energy (or the equivalent amount of -----

49. Jahn, "Psychic Phenomena: Engineering Perspective", page 139.

energy expended to acquire the information) based on the laws of conservation of energy. If the mind can acquire information and reorder the random processes of the physical world then it may be accused of being a "Maxwellian Demon". This little demon can supposedly control a small door between a hot chamber of gas and a cold chamber of gas. By letting only the coldest molecules out of the hot side and only the hottest molecules out of the cold side, the hot side will increase in temperature while the cold side will become colder, which violates the second law of thermodynamics. Do the information processes of the mind cause a reordering of the probability functions, thus causing a "real" energy influence on the environment? Does the conservation of energy apply to this type information transfer or ordering? If so, where does this energy come from? The relationship of energy, information, and entropy (or order) must be carefully studied to answer the questions posed by PSI and PK research.

All of the PK experiments utilize some form of visual feedback to aid in the operators' learning processes. In more traditional biofeedback equipment, the desired "signal" is removed from the other measurement "noise" and amplified to give continuous feedback. The resultant amplified signal can be utilized in a variety of feedback modalities such as color, sound or full scale meter readings. The visual feedback utilized by the Princeton PK experiments has some of the above properties; but it is possible that advances in the type and quality of the feedback may result in a better learning environment. For example, in the REG PK experiments, one might amplify the 1- to 5-percent change in the probabilities, and display the difference on a pretty color graph or use audio feedback proportional or related to the difference.

Other forms of "amplification" might also be investigated, such as building 1000 small REG devices to increase the number of bits sampled per second. These 1000 devices could each control the

color or intensity displayed on different sections on the same computer screen. This type of visual feedback compresses a large amount of data into a visually pleasing, real-time display. This kind of display could be used in a competitive game type of environment to tap into the goal-oriented nature of an individual's efforts.

Chapter 4

CONCLUSIONS AND FUTURE WORK

The term psychic research is usually associated with the study of "paranormal" phenomena. The engineering investigations of psychic phenomena indicate that most people have the raw capability for PSI, but this type of experience does not occur in each our lives on a daily basis. Our current understanding of PSI results in people treating it as a "non-ordinary" phenomena. In other words, PSI is viewed as something that does not impact our daily lives and is subsequently not very important. Some of the theories of PSI suggest that PSI phenomena is unconsciously used by people to achieve their goals practically every day. Remote Viewing is an example that demonstrates how research has changed our perception of how normal people can perform "psychic" tasks. Older experiments assumed that PSI could only be evoked in a special state of mind (i.e. hypnosis, Ganzfeld, sensory deprivation, or dreaming while asleep), but present day Remote Viewing experiments have shown how easy it can be evoked during normal quiet states of consciousness.

Psychic experiences are not common for most people on a daily basis. Unconscious efforts and goals may influence some activities to produce "lucky" circumstances or primitive "intuitions" but these are not normally considered to be psychic events. Just because a phenomena is not explicitly utilized on a daily basis does not make that phenomena any less real. As psychic research matures, other types of "ordinary" phenomena may be discovered to be related to daily occurrences of psychic functioning. Perhaps even the mind's influence over the brain may

be shown to be caused by psychic functioning, as predicted by some theorists. Maybe someday much of the fear about psychic functioning will disappear when it becomes less "paranormal" and is perceived as a natural part of our every day thinking existence.

The literature strongly indicates the existence of PSI but admits it is not well understood at this time. Robert G. Jahn, the Dean of the School of Engineering and Applied Science of Princeton University, stated "Psychic research is a legitimate

field for a high technologist to study".⁵⁰ More people need to agree with his view about PSI before large amounts of research will be performed. Historically, scientific breakthroughs often happen when current theories cannot resolve experimental paradoxes. In addition, the related technologies (i.e. math or material science) must be sufficiently advanced to assist in the formulation of the new theory. It is this author's opinion that the related technologies are present and the experimental necessity for continued research in psychic functioning is evident, and that this will lead to new discoveries about the functioning of psychic phenomena.

Current trends in psychic research include designing more high technology experiments with immediate quantitative feedback. This research is critical to the further understanding of the phenomena. The use of computers to help detect the minute changes in the device-under-influence will be critical for providing rapid feedback, as well as for building the data bases necessary for experimental records. Theoretical work must progress in parallel in order to be useful as a foundation for designing new experiments. As will be discussed in the next few paragraphs, a thorough understanding of information theory, quantum mechanics,

50. Jahn, "Psychic Phenomena: Engineering Perspective", page 136.

energy, entropy (or order), the physics of computation, and perhaps relativity may be required to develop a quantitative and testable theory for PSI. All information processing and computing is based on physics principles, which is restricted by limits such as the speed of light and the Uncertainty Principle. Therefore computational limits exist and are believed to be related to the development of a PSI theory for the reasons outlined in the next paragraphs.

Computer engineers keep building smaller, faster, and more "intelligent" machines, with the ultimate goal being to design a machine that can learn and think like a human being. The major restriction in the speed of the computers is the limitation in the effective memory bandwidth for very large memories. Computer engineers believe this shortcoming can be overcome by designing parallel computers that work on different parts of the same problem at the same time. To date, parallel solutions exist only for certain classes of problems, and highly parallel solutions have not been found for general-purpose computational problems.

Computer engineers have designed distributed systems to include many local memories, hoping to solve this effective memory bandwidth bottleneck. These systems tend to have synchronization overhead that becomes increasingly large as the granularity of parallelism becomes smaller. In essence, a distributed computer system tends to transform the memory bandwidth problem into a network bandwidth problem between the individual processor nodes. Another problem the computer and semiconductor companies are facing, especially the wafer scale integration groups, is that the size of these systems has been reduced to the point that heat dissipation, and propagation delay (due to wire lengths and the speed of light) are major constraints to the system design and performance.

In contrast to computers, the human brain, which depends on the millisecond electrochemical propagation times of neurons, is six to nine orders of magnitude slower than the sub-nanosecond propagation times of the fastest computer elements. To scientists who assume that a person's computational capabilities are due to the "computational engine" of the brain, these implementation differences of speed and power between computers and brains are contradictory. The assumptions that lead to the computational contradictions between people and computers must be re-examined based on the experimental results of psychic research. The next paragraph examines an alternative assumption for human information capabilities.

Digital communication bandwidth and computer memory bandwidth are both defined in terms of both time and space parameters (bits per second). Learning can be thought of as the organization of information into memory. Psychic phenomena indicate that time, space, and other forms of "shielding" appear not to be boundaries to the information transmission in Remote Viewing. This author believes that the possible discrepancy between the slow brain and the fast computer can be resolved if one assumes that the computational processes of the mind are based on the advanced information acquisition capabilities demonstrated by psychic functioning. The slow brain could then be viewed as a resonant antenna to the separate computational capabilities of the mind and not as a biological computer. If thinking involves these information acquisition capabilities, then this phenomena may be more "ordinary" than first believed.

The following five steps are recommended for continued work in the area of psychic research.

1. Develop a theory for psychic information transfer.
2. Test theory by simulation or applying to known phenomena.
3. Design and build a small experiment proposed by theory.
4. Collect data utilizing new experimental equipment.
5. Accelerate PSI learning using sophisticated visual feedback.

Developing a theory (item number 1 above) is a prerequisite for any serious research effort in this field for the following reasons. Experiments in PSI are providing more significant statistical results with better replicability, but the design of experiments is taking a scatter-gun approach. With limited research money and the expense of designing, building, and calibrating equipment (\$200,000 per machine), it seems that future research could be targeted better with a solid theory for PSI phenomena.

Einstein's theory of Relativity did not abolish Newtonian physics, but rather added a new onion layer of laws around it for particles traveling near the speed of light. Likewise, any new PSI based theory will not cause science to abandon what is already known but will add some additional descriptors about when certain conditions are valid. Just as quantum physics gave birth to such fields as semiconductors and lasers, so to will new technologies be born around a better understanding of how man interacts with information in the environment. Applying a new PSI-based theory to currently "understood" phenomena may give additional insight that could lead to new experiments. Testing and applying the theory (item number 2 above) is an important part of identifying where the "new onion layer" begins and the old layer of conditions and assumptions ends. The laws themselves may not be revolutionary but the consequences of those laws on technology and

our life-styles may be significant.

As stated earlier, designing new experimental procedures and devices should be based on a theory and its underlying assumptions. One assumption that is particularly relevant to PSI is the relationship between the brain and the mind. Many scientists believe that the brain is synonymous with the mind, much like a big computer. Unfortunately, no current physical laws can describe how a person's brain can perform psychic information transfer. Therefore, let it be assumed that the brain and mind have distinct roles, where the mind is capable of psychic information manipulation. With the assumption that the brain can interact with mind, then technologists could potentially build other "devices nearing the complexity of the brain" that allow manipulation of psychic information. Needless to say, the architectures of these "complex machines" would be very different from our present day computers, even though they might be implemented using semiconductor technology. The key point in this discussion is that the brain and the underlying computational assumptions must be reexamined from a completely new perspective in order to gain the insight needed to apply today's technology to design new experimental devices for PSI research.

Once new experimental devices are designed and built, test and calibration data bases must be collected (item number 4 above). This data must be collected initially to provide the statistical evidence of psychic functioning, but other forms of displays and protocols must also be designed to allow rapid learning of psychic functioning (item number 5 above). It is a goal that at some point in the experimental evolution, the PK devices will have such a high sensitivity that certain operators may be able to mentally draw images on a computer screen using PK. This kind of "product" may have sales potential and would place a new set of "product design constraints", that would be completely different from the

"laboratory experiment design constraints" currently influencing PK device design. Since the complexity of the feedback system does not appear to affect PK and ESP performance, this author recommends that high quality visual feedback systems be investigated to determine their impact on PSI learning. Of course the high quality visual display should be implemented in conjunction with the more traditional, statistically oriented, data-gathering techniques and fail-safe mechanisms.

In conclusion, emphasis should be placed on the theoretical efforts. The theoretical models should address issues brought up by other fields, such as psychology, medicine, and pharmacology as well as physics. An interdisciplinary theory that includes an information theoretic approach to consciousness, awareness, unconsciousness and non-ordinary states of awareness (i.e. dreaming, etc) would help bring in other interested technical groups. A strong emphasis should be made on the theoretical aspects in order to propel PSI research into the realm of solid physics and respectable science.

Appendix A

DESCRIPTOR RESPONSE QUESTIONS

These questions require that a significant part of the scene have this attribute in order to answer an affirmative.

1. Indoors?
2. Dark or night time?
3. Height or depth?
4. Well-bounded or walled in?
5. Confined space?
6. Hectic, chaotic, congested, or cluttered?
7. Highly colored objects?
8. Signs, billboards, posters or pictorial representations?
9. Motion or movement?
10. Sound, horns, or noises?
11. Lots of people present?
12. Animals, birds, fish, or insects?
13. Is there a dominant object or structure?
14. Central natural focus? (not man-made)
15. Is scene natural? (not man-made)
16. Monuments, sculptures, or ornaments?
17. Geometric shapes? (triangles, circles, arches or spheres)
18. Posts, poles, or other thin objects?
19. Doors, gates, or entrances?
20. Windows or glass?
21. Fences, gates, railings, or dividers?
22. Steps or stairs?
23. Object repetition? (i.e. cars in parking lot)
24. Planes, boats, or trains?
25. Major equipment, tractors, carts, or pumps?
26. Autos, buses, trucks, or bicycles?
27. Grass, moss, or ground cover?
28. Road, street, path, bridge, tunnel, hallway or tracks?
29. Water present?
30. Trees, bushes, or potted plants?

Appendix B

LIST OF REFERENCES

J. S. Bell, "On the problems of Hidden Variables in Quantum Mechanics", Review of Modern Physics, Volume 38, 1966.

Norma Bowles and Fran Hynds, PSI Search, Harper and Row Publishers, Inc., New York, 1978.

Ian A. Cook, "Microelectronic Device Vulnerability: An Experiment in Low-level Energy/Information Transfer", Technical Note Princeton Engineering Anomalies Research 82003, June 1982.

Brenda J. Dunne, Robert G. Jahn, and Roger D. Nelson, "An REC Experiment With Large Data-Base Capability, II: Effects Of Sample Size And Various Operators", Technical Note Princeton Engineering Anomalies Research 82001, April 1982.

Brenda J. Dunne, Robert G. Jahn, and Roger D. Nelson, "Precognitive Remote Perception", Technical Note Princeton Engineering Anomalies Research 83003, August 1983.

Richard Grigonis, "Sixth Generation Computers", Dr. Dobbs Journal, May 1984.

Robert G. Jahn, The Role Of Consciousness In The Physical World, AAAS Selected Symposia Series, Westview Press Inc, 1981.

Robert G. Jahn, "The Persistent Paradox of Psychic Phenomena: An Engineering Perspective" Proceeding of the IEEE, Volume 70, No 2, February 1982.

Robert G. Jahn, Roger D. Nelson, and Brenda J. Dunne, "Analytical Judging Procedure for Remote Perception Experiments II: Ternary Coding and Generalized Descriptors", Technical Note Princeton Engineering Anomalies Research 82002, April 1982.

Robert G. Jahn, Roger D. Nelson, and Brenda J. Dunne, "A Psychokinesis Experiment with a Random Mechanical Cascade", Technical Note Princeton Engineering Anomalies Research 83002, June 1983.

Robert G. Jahn, Roger D. Nelson, and Brenda J. Dunne, "Princeton Engineering Anomalies Research", Technical Note Princeton Engineering Anomalies Research 84002, November 1983.

Robert G. Jahn and Brenda J. Dunne, "On the Quantum Mechanics of Consciousness, with Application to Anomalous Phenomena" with Appendix B, "Collected Thoughts on the Role of Consciousness in the Physical Representation of Reality", Technical Note Princeton Engineering Anomalies Research 83005.1 and 83005.1B, December 1983, (1st revision, June 1984).

Roger D. Nelson, Brenda J. Dunne, and Robert G. Jahn, "An REG Experiment With Large Data-Base Capability, III: Operator Related Anomalies", Technical Note Princeton Engineering Anomalies Research 84003, September 1984.

Harold E. Puthoff and Russell Targ, "Direct Perception of Remote Geographical Locations" Electro/77 Special Session on the State of the Art in Psychic Research, 1977. Electro, New York, April 19-21, 1977.

Russell Targ and Harold Puthoff, Mind Reach, Dell Publishing Company Inc, 1977.

Russell Targ and Harold Puthoff, "Information Transmission Under Conditions of Sensory "Shielding" Nature, CCLII (October 1974), pages 602-607.

Russell Targ and Keith Harary, The Mind Race, Villard Books, 1984.

Benjamin B. Wolman, Handbook of Parapsychology, Litton Educational Publishing, Inc., 1977.