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Stanford Research Institute Project 3183

PERCEPTUAL AUGMENTATION TECHNIQUES

by

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CLIENT PRIVATE

I OBJECTIVE

The purpose of the program is to determine the characteristics of those perceptual modalities through which individuals obtain information about their environment, wherein such information is not presented to any known sense.

The program is divided into two categories of investigation of approximately equal effort, applied research and basic research. The purpose of the applied research effort is to explore experimentally the potential for applications of perceptual abilities of interest, with special attention given to accuracy and reliability. The purpose of the basic research effort is to identify the characteristics of individuals possessing such abilities, and to identify neurophysiological correlates and basic mechanisms involved in such functioning.

II PROGRESS DURING THE REPORTING PERIOD

A. Applied Research

1. Remote Viewing

As discussed in previous reports, the remote-viewing channel through which individuals obtain information about their environment appears to be a relatively well-developed stable channel in certain of our subjects. As will be seen below, for example, the channel appears to be of sufficiently high data rate that a knowledgeable analyst could discriminate among possible alternative technologies on the basis of descriptions provided by remote viewing of technical apparatus.

Given the observed degree of stability of the phenomena, a lengthy series of experiments were carried out in which certain variables were manipulated in order to test various hypotheses. These consisted of (a) the measurement of physiological correlates during remote viewing; (b) the effects of manipulating the feedback variable over the range 1) mid-testing feedback via walkie talkie, 2) delayed post-experiment feedback, 3) no feedback, the latter providing a test which permitted rejection of the hypothesis that apparent remote viewing was simply precognition of feedback data; (c) determination of whether resolution and discrimination on the order of technical laboratory equipments was possible, verified unambiguously in the affirmative.

(a) Local Targets with Mid-Experiment Interrogation and Feedback (Training Series)

In this series of training experiments, designed to give immediate data to experimenters and subject, a subject is asked to take part in a remote viewing experiment under the following conditions.

The subject and two experimenters (one of whom was R.T.) are in a first floor laboratory in building 30 at SRI. A second experimenter (H.P.) leaves the area and proceeds to a remote location of his choosing. None of the experimenters with the subject know of the remote target location. H.P. and R.T. are in two-way radio communication via walkie-talkie, (a) to provide the experimenter at the target location real-time data and (b) to give the subject immediate feedback after he has made his assessment of the target. By this means the subject is given an opportunity to learn to separate real from imagined images. We stress that this is not to be considered a demonstration-of-ability test, but rather a training step. In these experiments we also monitor physiological correlates, as discussed in Section B.3. Following is a description and summary of the seven experiments of this type that were carried out. The first five experiments were carried out with Subject S-4, the last two with Subject S-3.

1) For the first experiment in the series, the remote experimenter was standing on a small bridge over a stream passing through a gully. The subject described a hill with a small amount of vegetation on the top, and some gray shingles, like a roof, over water, an almost error-free description of the location. Although there was no corrective feedback, the subject's narration was elicited by the remote experimenter via questions, and therefore it would be difficult to quantify the amount of remote viewing present given the possibility of unknown cueing.

2) The remote experimenter was standing in the middle of a bed of purple iridescent flowers surrounded by a bright green hedge. Before there was any radio contact the subject said that her main perception was of "iridescent blue and lush green vegetation". This is judged to have enough commonality to be considered a reasonable match.

3) The remote experimenter had gone to a kiosk bulletin board in the shape of a wooden cylindrical tower with a brown wooden roof. The structure is about 15 feet tall. The subject's first words, before radio communication was established, were: "He could be near a grey wooden tower with a brown roof." This was considered a direct hit and the subject was told that this was the case. The subject went on to describe correctly the roof around the tower as sloping but she incorrectly described the tower as square. The small-size perspective was not observed by the subject.

4) The experimenter was standing on the edge of a concrete

waterway made up of several zigzag elements. It is a decorative watercourse through a park. The subject's first comments are of a "strong zigzag". With a question from the remote experimenter as to its orientation (i.e., whether horizontal or vertical), her description evolves into a "zigzag water channel with concrete sides". We are confident that the feedback she received in this case by questioning could not have conveyed this information.

5) The remote experimenter stood next to a large oak tree. In his immediate forward field of view was a large circular brick wall surrounding a plaza area containing a fountain. The subject's first comments prior to radio feedback comprised a description of large trees and a brick elliptical wall that was nonfunctional. The subject was then given feedback that the primary things to be seen from that location were in fact a large tree and a circular brick enclosure.

6) The remote experimenter went to the top of a 100 foot wooden tower on which was mounted radar equipment. The tower is painted yellow and has a wooden wall enclosing the top. By and large, much of the material volunteered by the subject does relate to the target location. For example, he eventually described it as a yellow tower before either the color or the tower were mentioned, although the height was not cognized. As the first in a training series on local viewing for this subject there was considerable radio communication and therefore although remote viewing was in evidence, no clear judgment can be made as to quality.

7) The remote experimenter in this experiment walked through a blacktop parking lot past a blue construction building, entered a park along a footpath through the grass, and then stood next to a fountain.

The subject described the above material essentially without feedback or radio contact. As a single narrative, he told of first seeing blackness which he identified as an asphalt parking lot behind the experimenter, and told that there was a blue building nearby. When this was confirmed, the subject went on to describe a white footpath through grass and entry into a depressed area. The subject then asked if the area was a fountain, which was confirmed. This latter performance is indicative of the most successful perceptions that we have seen from this subject.

We stress again that this particular series, involving as it does mid-experiment questioning and feedback, is to be considered a training series to provide subject and experimenter alike means whereby various aspects of the phenomena may be examined in detail. Nevertheless, sufficient descriptive elements were given before feedback to indicate unambiguously a functioning ability. For a summary of pre-feedback identifications, see Table 1. Since these experiments were carried out with monitoring of physiological correlates, it was established that such monitoring is not intrusive.

Real-time observation of the remote site under conditions of real-time subject interrogation leads to the following best-effort qualitative interpretation: Remote viewing generally does not provide an integrated visual impression of an entire scene in the sense of direct visual observation. Rather, the subject provides an overall impressionistic gestalt together with individual salient elements, a response similar to that obtained under conditions of tachistoscopic viewing. Remote viewing is, however, generally (for experienced subjects) at a level sufficient to permit discrimination among known alternatives on the part of an analyst.

TABLE 1

SUMMARY OF REMOTE VIEWING EXPERIMENTS

WITH MID-EXPERIMENT QUESTIONING AND FEEDBACK

Target Location	Subject Description Before Any Feedback Given
1. Embankment with bridge and stream	Hill with vegetation at top only
2. Iridescent purple flower bed surrounded by bright green hedge	Iridescent blues and greens, like feathers.
3. 15 foot tall cylindrical wooden kiosk with a brown metal roof	Grey tower with a brown roof
4. Zigzag water channel with concrete sides	Strong zigzag shape
5. Large oak tree next to brick enclosure	Large chestnut tree and non-functional brick wall.
6. 100 foot wooden radar tower	Stone wall taller than experimenter
7. Blue building and circular fountain	Blue building and circular fountain

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(b) Variable Feedback Study

In this second series of eight experiments, the variable manipulated was the type of feedback that was given to the subject. The feedback covered the range (a) immediate feedback via walkie-talkie as before, (b) subject taken to the remote site after the experiment, (c) no feedback given whatsoever. In this latter case the subject was not even told whether or not she was correct.

One aspect of the examination of the effect of feedback was to test a hypothesis proposed by Dr. Gerald Feinberg who had witnessed some of our early remote viewing experiments. A paper of his entitled, "Precognition--Remembrance of Things Future", is included as Appendix A. His theory, briefly stated, proposed that since the subject eventually gets to perceive directly the target location with this normal senses, he might in principle gain access to that information by reading his own mind precognitively. The physical basis for this would be the electromagnetic advanced potential wave carrying his future memory backward in time, thus allowing it to be "remembered" before it took place. Although this summary does not do justice to the theory, it is clear that the way to test such a theory is to withhold data entirely from the subject as to the nature of the target location.

With the two goals of testing the Feinberg hypothesis and measuring the overall effects of feedback, we arranged that walkie-talkie feedback, delayed (post-experiment) feedback and no-feedback experiments were randomly intermixed. The protocol for all experiments involved one of the experimenters leaving the subject with the other experimenter in the SRI laboratory. The traveling experimenter would be allowed fifteen minutes to arrive at his target location. He would then pay close attention to his surroundings for ten minutes, after which he would return to SRI. In the first five experiments, H.P. was the outbound experimenter, in the last three experiments the experimenter roles were reversed with R.T. as the outbound experimenter. The entire set of experiments were carried out with Subject S-4.

1) The formal courtyard of SRI's International Building, about 20 x 20 meters surrounded on four sides by two-story concrete buildings, served as the first target. In the center of the courtyard is a presently inactive fountain and small trees planted in rows. During the experiment, the outbound experimenter (H.P.) stood in that fountain. There was no mid-test feedback, only post-experiment feedback.

The main descriptive elements of the subject pertained to a formal garden with a little dry fountain in the middle. Other elements that the subject described were a wrought iron fence, a trough leading to the fountain, and the experimenter climbing steps. In addition to the above correct descriptions, the subject also described a blue sign and railroad tracks behind a fence. These latter elements are not present at the site.

The formal garden ambience is clearly a correct gestalt of the place and would allow for easy discrimination from the other target locations that follow. Except for the two incorrect data noted above, the rest of the description was basically coherent and accurate.

2) The target location was a 30-foot long trailer used by SRI to house its mobile radio transmitter. Puthoff walked back and forth outside this stainless steel trailer for the ten minutes of the experiment. In our estimation the subject gave a nondefinitive set of impressions

which were too general to be considered as specifically related to the designated target. No feedback was given either during our following the experiment.

3) A bicycle shed behind SRI's building 30, brightly lit by sun shining on translucent white plastic walls, comprised the third target. The outbound experimenter (H.P.) sat on a bicycle.

The subject's main description detailed how brilliantly the place was lit with no shade. The descriptions which followed dealt with converging metal spokes. Her impression was that the metal spokes divided the space of a circular area rimmed by some other material. She submitted a drawing showing a stick figure representing the experimenter (H.P.) standing on one of the spokes of an eight spoked wheel, about a man's height in diameter. Since the content of her ten minute description dealt with the elements brightness and metal spokes, the inaccuracy is to be found in the scale of the description, and of course her omission of the fact that the spoked wheel belonged to a bicycle. As in the previous experiment, no feedback was provided to the subject either during or following the experiment.

4) The fourth target was a wooden bulletin board kiosk, used earlier as a target, about half a mile from SRI. It is a cylinder about fifteen feet high with a conical roof having a three foot overhang. Mid-test communication via walkie-talkie permitted questions to be asked by the remote experimenter, and post-experiment feedback was also given.

As in experiment two, nothing in the subject's description would allow one to identify the target. Feelings of anxiety were expressed along with a request to terminate that location as a target because of "fear of a primal force and danger". A purely speculative point could be made concerning the fact that while at the target location the experimenter spent his time reading an announcement of a meeting about Vietnamese children mained during the war. A separate test series would be required to test such a hypothesis.

5) The remote experimenter went to a rectangular concrete platform containing three cylindrical fire hydrants. He balanced himself as he walked on the wooden 2x2 header bordering the concrete pad. Mid-test communication and post-experiment feedback were given. The subject's first impression prior to any communication was that the experimenter was tightrope walking on a long narrow ledge out in the open, as, for example, on the top of a wall. Following confirmation of the tightrope aspect, the subject volunteered a description of metal tubes bisecting the masonry.

The correspondences to basic elements are manifold, including description of experimenter activity, and there are no incorrect data. In our estimation the essentially null mid-experiment feedback could not in this case have provided the data obtained by the subject.

6) The target site in this experiment was a children's playground about 4 miles from SRI. The outbound experimenter, R.T. in this case, spent the ten minute experimental period riding on a small merry-go-round in a sand box.

The subject describes R.T. as riding on something that leaves a wake, although not necessarily in water, e.g., it could be in the air. She sees sand or mud, and the "vehicle" he is riding on is described as curved and looks like chrome (correct). He is also described as being in movement the whole time, happy, joyful, etc. She also claimed to see an axle, but could not give any details.

Although the merry-go-round as a gestalt was not recognized, the ambience of the place was well conveyed by the subject's descriptions. There was feedback to the subject only the day following the experiment.

7) The seventh target was an auditorium at SRI with a flood-lit stage and red carpets throughout. The outbound experimenter was R.T..

The subject's description was of a patterned carpet in a large well-lit room. The subject saw a scalloped design covering this interior space, in reds and maroons, and submitted a drawing which matched well the array of seat backs. She correctly described the experimenter as leaving the brightly lit area (stage) after five minutes and moving to a second area in the room.

This was the first indoor target area we have used with this subject. We consider her description excellent both with regard to structure and ambience, though again the significance was not cognized. Post-experiment feedback was given.

8) A church in Palo Alto served as the final target in the series. It is a tall, modern, very elegant building.

The subject's first comments are of a tall august lofty building that must be a library or a church, very solemn. She describes a cross or kite at the end of the solemn hall. The outside is correctly described as gray masonry with cutouts for windows. The remote experimenter (R.T.) is correctly described as leaving the building by a concrete passageway. We consider this to be the best match of the series with respect to structure, ambience, and activity of remote experimenter. No feedback was given either during or following the experiment.

In this series of eight experiments, summarized in Table 2, three feedback protocols were employed. They included the use of a walkie-talkie communication during the experiment, feedback after the termination of the experiment, and no feedback at all. Since mid-test communication was used in some of these experiments, this series was not intended as a demonstration-of-ability test, but rather as a training series with a secondary goal of determining whether feedback to the subject is a necessary component of the remote viewing phenomenon.

The detailed tape recorded transcript of experiment number 8, the church, is one of the more accurate and complete descriptions we have ever obtained from a remote viewing experiment. In this case the subject was given no feedback whatsoever as to the nature of the target or the correctness of her description. We conclude from this experiment, and supporting evidence from the spoked wheel drawing from experiment 2, that a channel of significant capacity exists between a subject and a remote location even in the absence of feedback. Furthermore, from our analysis of the data and conversations with the subject, it appears that the existence of mid-experiment communications is more of a disturbance than a help to the subject in establishing rapport with the remote experimenter.

Finally, the roles of R.T. and H.P. as interrogator and outbound experimenter were interchanged for some experiments with no observable difference, indicating that the remote-viewing phenomenon is not strongly personality dependent.

TABLE 2

SUMMARY OF VARIABLE FEEDBACK EXPERIMENTS

Remote Site	Type of Feedback	Evaluation
1. SRI landscaped court yard	Post-exp.	Described correctly as a formal garden with dry fountain
2. Radio trailer	None	No relation to target
3. Bicycle shed	None	Correctly described bright area and drew wheel with metal spokes; size perspective lacking
4. Wooden Kiosk	mid-test	No relation to target (see text)
5. Concrete platform	mid-test	Accurately described target and experimenter's activity
6. Merry-go-round	post-exp. (1 day)	Had experimenter in moving vehicle which couldn't be identified
7. Auditorium	post-exp.	Correctly described large indoor area, brightly lit, with red rug
8. Church	None	Tall solemn, august building, church or library

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(c) Technology Series

In this section we describe a series of experiments designed to measure the approximate resolution capability of the remote viewing phenomenon. We have established in other work that a high data rate channel exists between a remote viewing subject and a distant site. In this work we investigate the amount of specific detail that a subject is able to obtain concerning a remote and unfamiliar scene.

Just prior to these experiments we had carried out experiments with subjects S-3 and S-4 to measure the physiological correlates of remote viewing and to test feedback hypotheses. One of the observations that we made at the conclusion of that work was that the quality, accuracy, and coherence of the descriptions provided by both these subjects appeared to be improving. We therefore asked them to participate in this series of technology experiments in which they would attempt to describe laboratory equipment of the type with which they may not be familiar. As is now standard in our protocol, they were asked simply to describe what they saw rather than name the object. There were four experiments in this series, and the subjects were successful in obtaining significant information in all cases.

In the first three experiments one experimenter left the subject with a second experimenter blind to the target and by random protocol selected a piece of apparatus with which to interact, located in a part of SRI where the subject had not been previously. The experimenter then used the equipment in the appropriate manner for ten minutes, after which he returned to the laboratory. The subject was asked both to describe the apparatus and to submit drawings.

big box painted matt black in the center of a large room. The front of the box was said to have a glass porthole like a washing machine with blue light coming out of it. She described the experimenter as looking at that light and using switches located under the porthole to do something with the machine.

The description was sufficiently accurate that a technically-oriented analyst might reasonably be expected to identify the target from among a restricted range of possibilities. As is often observed, the basic elements are described correctly while the analytical significance is not cognized.

3) Target Number Three consisted of a drill press in a machine shop. The target was a seven-foot-high, belt-driven drill press, which was used by the outbound experimenter (R.T.) to drill holes in a piece of wood for the ten-minute experimental period.

The subject described the object as being a man-sized machine with wheels, gears, and some sort of conveyer belt. She drew a picture of a belt operating between a pair of pulleys. She also described an "anchor or umbrella" which she drew as a hub with four spokes, at the end of each of which was a knob. This resembles accurately the handle which is used to raise and lower the drill. She also drew a vertically-oriented graph, which is in fact on the front of the machine to indicate depth of drill motion. The three drawings together with her verbal description contain many elements that in our estimation would allow an analyst to assess correctly the nature of the machine, given a restricted class of possibilities.

These three targets were described by Subject S-4. Her only input information was that the experimenters would make use of some laboratory equipment at SRI. It is clear that the three descriptions are differentiated from each other, and that varying amounts of technically correct information was obtained and recorded by the subject.

4) An abacus in a day/date/clock pedestal served as target number 4. The target is shown in Figure 1. The target object for this experiment was purchased on the day of the experiment in New York City for the purpose of measuring the resolution of Subject S-3 in the remote viewing situation. After the abacus was purchased, the subject was called and asked to take part in a remote viewing experiment in our hotel room.

Unlike the usual protocol, in this experiment both experimenters knew the description of the target object. We therefore had pre-recorded the entire experimental preamble for the subject which had been carefully checked in advance for unintentional verbal cueing.

Pre-recorded Preamble:

"Hal and I have brought a present for you. We wandered around New York this morning and we bought an object. This object is of the type that one interacts with, and Hal will use it for its normal purpose. Today is Friday, September 27, 1974. As in all our remote viewing experiments, we'd like to ask you to describe the object as you see it rather than attempting to give the object a name."

Shortly after the subject entered the hotel room, one experimenter (H.P.) took a large locked suitcase containing the target into the wash room. He locked the door and removed the abacus from the suitcase. He then quietly moved the wooden balls back and forth on their wires. We had verified in setting up the experiment that this action was inaudible.

The instruction tape was played to the subject by the other experimenter (R.T.), and all subsequent interactions between himself and the subject were recorded.

The subject produced within one minute an outline drawing (Figure 2(I)) which he said was "it", although he didn't know what "it" was. (The large purplish-silver object corresponds well with the interior of the suitcase.)

The experimenter then asked the subject for more detail. A second drawing (Figure 2(II)) was produced by the subject who described the object as a "game box with little balls". He felt that that was all he could do and handed in his second drawing. We then terminated the experiment and showed him the target object. The entire experiment took place in approximately five minutes total time.

Considering the high strangeness of the target object, and the essentially total lack of restriction on the possibilities at the outset as far as the subject was concerned, it appears that the correlation of the subject's drawings and description with the target constitute a highly significant result.

The results of the four-experiment technology series are summarized in Table 3. These four experiments clearly indicate that the remote viewing channel can be used to obtain information about mechanical and technical apparatus, in addition to the geographical and architectural information which had been obtained in our experiments previously. In these present experiments the subjects were not technically oriented as to the possible types of targets that might be encountered. We do

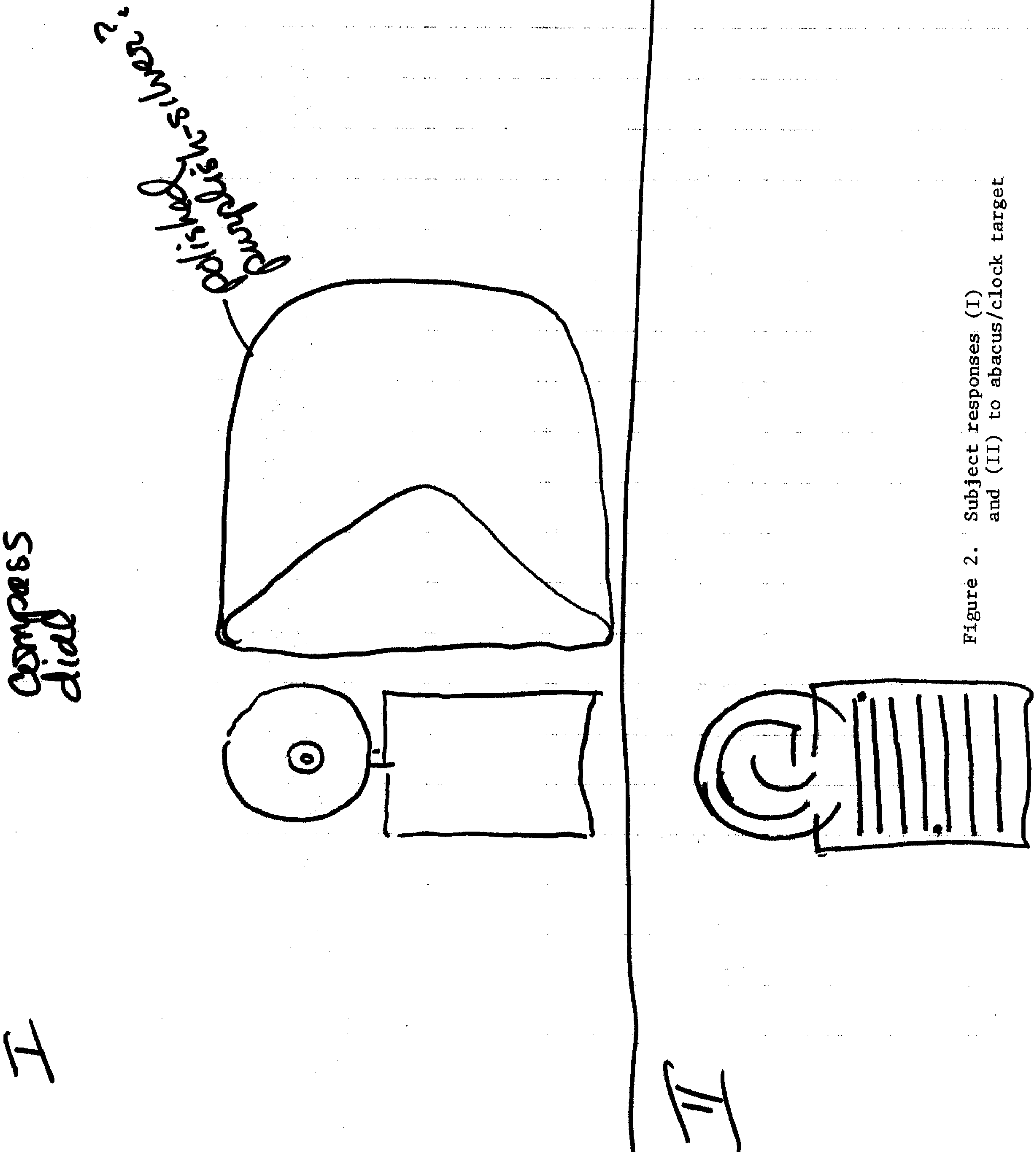

Figure 2. Subject responses (I) and (II) to abacus/clock target

Table 3

SUMMARY OF REMOTE VIEWING TECHNOLOGY SERIES

Target	Subject Responses
1. Link Trainer flight simulator	Experimenter crowded into very small space. Gray diffuse light. Experimenter described as doing something with both hands.
2. 23" Video Monitor with keyboard	Big black box in center of room. Glass porthole with blue light. Switches underneath porthole.
3. Drill press	Man-size machine with belt and pulley. Spoked handle, vertical graph.
4. Abacus	Game box with balls. Drew six tracks with balls in them and a circular pattern below.

not at this time know whether their ignorance of the possible target pool is a help or a hindrance to their descriptions.

We plan to continue working with this type of target material to gain further information as to the resolution capability of various subjects in this perceptual area.

(d) Project Atlas Remote Viewing

A second remote-viewing experiment has been carried out on a client-designated target of interest, a European R&D test facility†. The subject for this experiment (S-3) was given map coordinates in degrees and minutes and told only that the target was a technical facility. The subject's response follows. A map accompanying the description is shown in Figure 3.

"First view taken at 11.00 a.m., EST (27 Aug 74)

The given coordinates gave a view of a rather flat environment composed of what looked like sand dunes covered intermittently with a scrubby grass. The wind was blowing, and the view was at night (approx. 12 hours difference).

The view was hovering over a road running NNW, and there could be seen a fence to the right, and beyond that a series of rectangular buildings in rows. There appeared to be a network of roads and lots of wire fences. A strange orange circular platform could be seen, but not identified as to purpose. There appeared to be tall towers in the distance, and around one tower-like structure there were a lot of lights and activity.

Second view taken at 12.25 a.m., EST (28 Aug 74).

Again, the wind was blowing. The sun was reflecting off the ground, and it seemed dusty. There appeared to be huge fenced perimeters (steel fencing?). There are hills or mountains to the south, and also some high-power voltage lines. There is a marsh (?) to the NNW.

Comment: Tiredness at the second viewing seemed to inhibit mobility in the view. Also, due to the complexity of the structures at the site, it is difficult to progress without some form of feedback. It is possible that the coordinates suffice to locate

†The first experiment was carried out with Subject S-1.

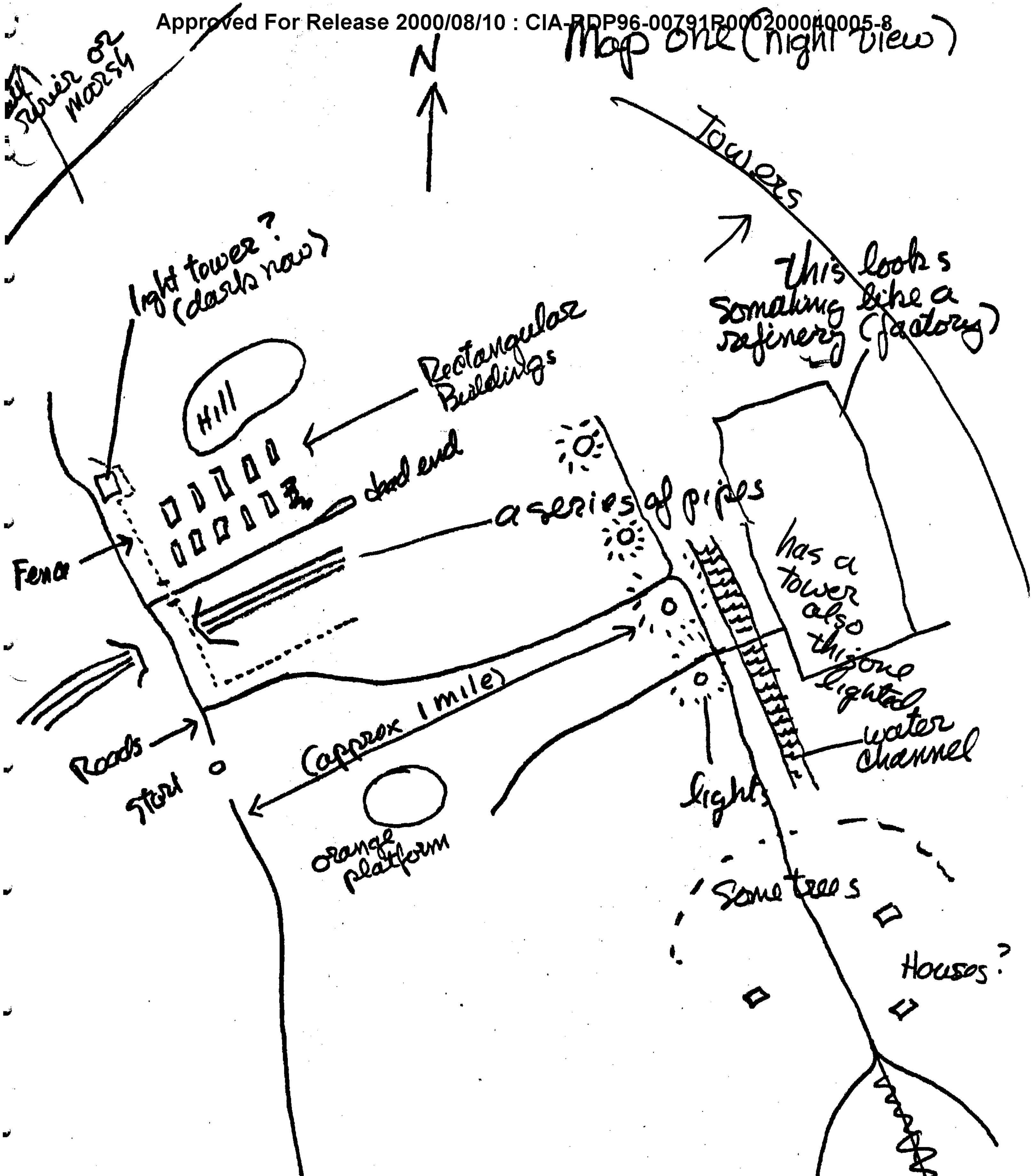

Figure 3. Drawing of Project Atlas site submitted by Subject S-3

the perception at the general site, but that preciseness as to artificial structures, especially in a complicated area, will have to have some additional orientation sequence.

MAP 1 follows."

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Evaluation of the data by the client is underway.

B. Basic Research

In addition to the testing of individuals under conditions which yield data indicating the feasibility of the application of paranormal abilities to operational needs, fifty percent of the effort is devoted to identification of measurable characteristics possessed by gifted individuals, identification of neurophysiological correlates which relate to paranormal activities, and identification of the nature of paranormal phenomena.

1. Criteria for the Determination of Gifted Individuals

(a) Remote Viewing of Natural Targets

Data continues to be taken on the remote viewing phenomena. As this report goes to press, Subjects 4 and 6 have completed the required series of nine sites, and the results will be judged and included in the following report.

(b) Line Drawings

The line drawing series has yet to be completed on all subjects.

(c) Four-State Electronic Random Stimulus Generator

As discussed in detail in Progress Report #3, the determination of the state of a four-state electronic random stimulus generator comprises one of the three screening tests. The target is in the form of one of four art slides chosen randomly (p = 1/4) by an electronic random generator. The generator does not indicate its choice until the subject indicates his choice to the machine by pressing a button. As soon as the subject indicates his choice, the target slide is illuminated to provide visual feedback as to the correctness or incorrectness of his choice. Until that time both subject and experimenter remain ignorant of the machine's choice, so the experiment is of the double-blind type. The machine choice, subject choice, cumulative trial number, and cumulative hit number are recorded automatically on a printer.

For the purpose of screening, each subject is required to complete 100 25-trial runs (i.e., a total of 2500 trials). Since Progress Report #3, an additional subject (S-4) has completed the required number of runs. The machine screening data now stands as shown in Table 4.

Table 4

SCREENING DATA: FOUR-STATE ELECTRONIC RANDOM STIMULUS GENERATOR

Subject	Mean Score/100 Trials Over 2500 Trials	Binomial Probability
1	25.76	0.22
2	29.36	3×10^{-7}
4	25.76	0.22
6	25.40	0.33

2. Identification of Measurable Characteristics Possessed by Gifted Subjects

Medical and Psychological Evaluation

The medical and psychological evaluation of program participants is continuing at the Palo Alto Medical Clinic under coordination of Dr. Robert Armbruster, Director of the Department of Environmental Medicine. The work is close to being completed, as indicated in Table 5 and 6. The raw data for subjects 2, 3, and 6 are included in Appendices 2, 3, and 4. Summarized data and interpretation will follow at program completion.

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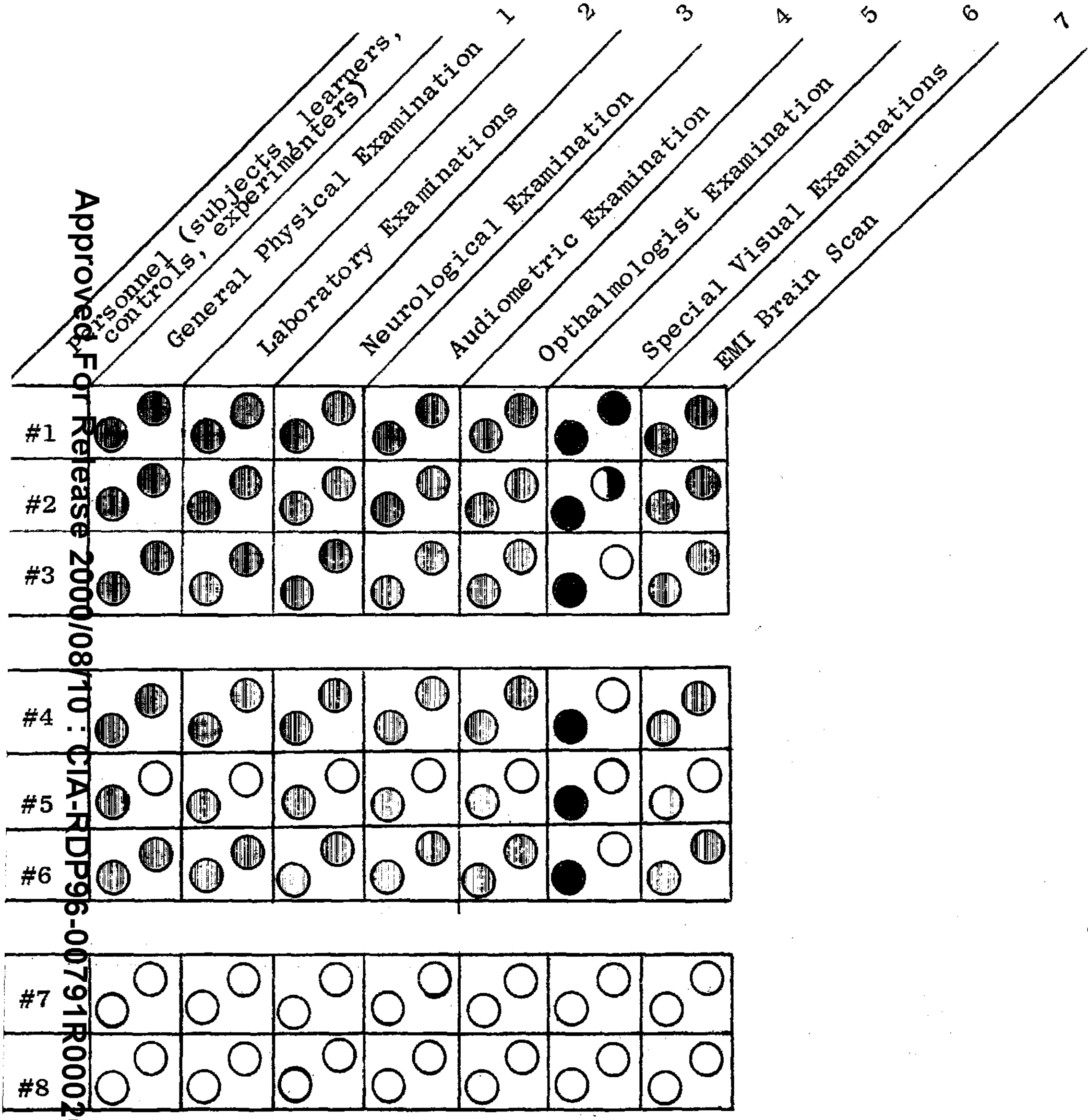

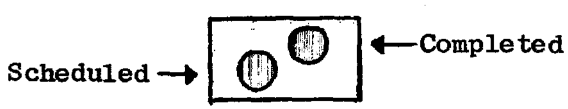

MEDICAL EXAMINATION Table 5

Personnel #1 - 3, subjects; #4 - 6, learners/controls; 7, 8, experimenters.

1. General Physical Examination
   Complete medical
   Family history
2. Laboratory Examinations
   SMA-12 panel blood chemistries
   Protein electrophoresis
   Blood lipid profile
   Urinalyses
   Serology
   Blood type and factor
   Pulmonary function screening
   Electrocardiogram 12-lead
3. Neurological Examination
   Comprehensive
   Electroencephalogram, sleeping and routine
4. Audiometric Examination
   Comprehensive
   Bekesy bone conduction
   Speech discrimination
   Impedance bridge test
5. Opthalmologist Examination
   Comprehensive
   Card testing
   Peripheral field test
   Muscle test
   Dilation funduscope
   Indirect opthalmoscopic and fundus examination
6. Special Visual Examinations
   Electroretinogram (Stanford Med.)
   Dark adaptation test (Stanford Med.)
   Visual contrast sensitivity (SRI)
7. EMI Brain Scan

Palo Alto Medical Clinic — Stanford Medical Center — SRI

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Table 6

PSYCHOLOGICAL EXAMINATION

Personnel #1 - 3, subjects;
#4 - 6 learners/controls; #7 - 8, experimenters.

Personnel (subjects, learners, controls, experimenters)	1 In-depth interview	2 W.A.I.S.	3 M.M.P.I.	4 Benton Visual Memory Test, Wechsler Memory Scale	5 T.A.T. and Rorschach	6 Bender Gestalt Test	7 Luscher color test	8 Strong Aptitude/Values Test	9 Cognitive Style Preference Test
#1	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	● ●
#2	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	● ●
#3	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	● ●
#4	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	● ●
#5	◍ ○	◍ ○	◍ ○	◍ ○	◍ ○	◍ ○	◍ ○	◍ ○	● ○
#6	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ◍	◍ ○	◍ ◍	● ●
#7	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	● ●
#8	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○	○ ○

● SRI ◍ Palo Alto Medical Clinic

3. Identification of Neurophysiological Correlates Which Relates to Paranormal Activities

As part of the program to determine whether physiological correlates can be used as an indicator of paranormal functioning, measurements are obtained during a random selection of remote viewing experiments. In these experiments the subject is connected to physiological recording instruments and a four-channel polygraph. Baseline and experimental measures of the following observables are made: 1) Galvanic skin response (GSR) is recorded using finger electrodes taped in place on second and fourth fingers; 2) Blood volume/pulse height is recorded using a reflected-light plethysmograph; 3) Unfiltered EEG is recorded from the right occipital region; 4) Percent-time in alpha (8-12 Hz) is recorded on the fourth channel. The alpha filter is a sharp cut-off digital type with essentially zero-pass outside the prescribed bandpass limits.

During the course of an experiment the subject is asked to describe his perceptions as to the nature of the remote target. His comments are tape recorded and noted on the polygraph, along with the time. A correlation is then attempted between those descriptions which are found to be uniquely correct and accurate, and the corresponding sections of polygraph recording. Of the correlates being monitored, the one which seems the most promising is the unfiltered EEG. In our preliminary analysis of the data it appears that there is often an overall reduction in EEG power in the twenty-second period just before a subject renders a correct description. Subsequent to this observation, we have learned that Janet Mitchell at the American Society for Psychical Research made very similar detailed observations in her studies with Subject 3, also in remote viewing experiments. Considerable data remain to be analyzed, and completion is targeted for the next reporting period.

4. Identification of the Nature of Paranormal Phenomena and Energy

(a) 23rd Annual International Conference--Quantum Physics and Parapsychology, Geneva, Switzerland, August 26-27, 1974

A major input to the researchers Puthoff and Targ during the reporting period was afforded by attendance at a closed working conference sponsored by Parapsychology Foundation, Inc., New York. The conference was set up to provide discussion on the identification of the nature of paranormal phenomena and energy. The attendees and their affiliations are given in Table 7, along with the titles of the papers presented. A significant outcome of the papers (and discussions which followed) was that data concerning paranormal processes are not in violation of but rather are commensurate with the basic principles of information theory and quantum processes. It was considered that this conclusion could be drawn even though the precise mechanisms still elude specification.

A conservative summary of the conceptualizations involved includes the following:

(1) Researchers in the area of psychokinesis appear to be plagued by results whose amplitudes have a signal-to-noise ratio near unity, regardless of the process or mechanism involved. A number of observations indicate that rather than simple perversity, what is being articulated is a coherence phenomenon involving partial mobilitation of system noise, and thus the magnitude constraint. That is, when a subject is asked to interact with an experimental setup, one often first observes a reduction in noise followed by a signal, as if the components of the noise spectrum had been brought into phase coherence. (Such an interpretation does not

Table 7

Program, 23rd Annual International Conference--Quantum Physics and Parapsychology, Geneva, Switzerland, August 26-27, 1974

"Foundations of Paraphysical and Parapsychological Phenomena," Evan Harris Walker, Ballistic Research Laboratories, Aberdeen Proving Ground, Maryland, U.S.A.

"Precognition--A Memory of Things Future?" Gerald Feinberg, Columbia University, New York, U.S.A.

"Parapsychology, Quantum Logic and Information Theory," C.T.K. Chari, Madras Christian College, Madras, India (read by Harold Puthoff).

"Quantum Paradoxes and Aristotle's Twofold Information Concept," O. Costa de Beauregard, Institut Henri Poincare, Paris, France.

"Life and Quantum Physics," V.A. Firsoff, Royal Astronomical Society, London, England.

"Physics, Entropy, and Psychokinesis," Harold Puthoff and Russell Targ, Stanford Research Institute, Menlo Park, California U.S.A.

"Remote Viewing of Natural Targets," Russell Targ and Harold Puthoff, Stanford Research Institute, Menlo Park, California U.S.A.

"Parapsychology as an Analytico-Deductive Science," J.H.M. Whiteman, University of Cape Town, Cape Town, South Africa.

"A Logically Consistent Model of a World with Psi Interaction," Helmut Schmidt, The Institute for Parapsychology, Durham, North Carolina, U.S.A.

"Connections Between Events in the Context of the Combinatorial Model for a Quantum Process," Ted Bastin, Cambridge Language Research Unit, Cambridge, England.

necessarily deny the possibility of large macroscopic effects.)

The subject thus appears to act as a local negentropic source. If true, it may be more advantageous as a practical matter to work with extremely noisy systems, rather than with highly constrained or organized systems, in order to maximize possible effects due to the introduction of order.

(2) Paranormal phenomena often appear to be more the result of coincidence than the effect of a well-defined cause. Again, rather than being the result of the perversity of nature, the observed goal-oriented synchronicity may indicate that physical systems are more easily manipulated at the global level of boundary conditions and constraints rather than at the level of mechanism. Thus, the apparency that a given desired result can be explained away by a coincidental but "natural" event needs to be explored more fully. Unexpected but natural causes may be the effect of a series of causal links, outside the defined experimental boundaries but representing an unforseen line of least resistance. At worst, such causal links may in fact be unobservable in the sense of the hidden variables concept in quantum theory, but nevertheless, act as instruments of the will.

(3) Paranormal phenomena appear to be intrinsically spontaneous; i.e., it is difficult to evoke paranormal phenomena "on cue", with the result that the phenomena are often considered to be not under good control, and therefore not amenable to controlled experimentation. This difficulty is so pronounced that it is likely that we are observing some macroscopic

analog of a quantum transition, an event similarly unpredictable in time except as a probability function. If the analogy is correct, experimentation in this area simply needs to be treated in the manner of, for example, weak photon experiments.

(4) Possibly related to item (3), the more closely one attempts to observe paranormal phenomena, the less likely one is to see them, a factor considered by many to support hypotheses of poor observation, fraud, etc. To a sophisticated observer, however, simple dismissal does not stand up under scrutiny. Invoking again the idea of a macroscopic analog of a quantum transition, we may, as observers of delicate phenomena, be witness to observer effects generally associated with the uncertainty principle. Paradoxically, from the subject's viewpoint, the production of the phenomena may also be an observer effect, perturbing as it does the expected behavior of a system. In this model the scrutiny of paranormal phenomena under laboratory conditions could in principle be considered to be collective phenomena involving interfering observer effects in a manner known to occur at the microscopic quantum level.

(5) Finally, it appears to be useful as a guiding principle to recognize that all of the phenomena dealt with in macroscopic psychoenergetics are totally permissible at the microscopic level within the framework of physics as presently understood. It is simply that time reversibility, tunneling through barriers, simultaneous multiple-state occupation, etc., are generally unobservable as gross macroscopic phenomena for statistical reasons only, as codified in the concept of increasing disorder (entropy). Therefore, it may be appropriate to consider an individual with paranormal abilities primarily as a source of ordering

phenomena of sufficient magnitude so as to restructure the otherwise random statistics of the macroscopic environment.

(b) Precognition Model

As discussed in Section II A.1.(b), an hypothesis which required consideration was the possibility that apparent paranormal perception was instead precognition of post-experiment feedback, an hypothesis easier to justify within accepted paradigms of electromagnetic theory. (See Appendix I.) Therefore, the experiments of Section II A.1.(b) were carried out with the testing of that hypothesis as a basic research objective. By task, that experiment is part of Program II (Basic Research), but is presented in Section II to preserve the chronology of experimentation. As indicated in the summary, the results obtained in that series are deemed sufficient to permit rejection of the precognition hypothesis.

(c) Information Theoretic Approach to the Use of Paranormal Channels

Independent of the mechanisms which may be involved in psychoenergetic phenomena, observation of the phenomena implies the existence of information channels in the information-theoretic sense. Since such channels are amenable to analysis on the basis of information-theoretic techniques, headway can be made in determining channel characteristics such as bit rate, independent of a well-defined underlying theory (in the sense that thermodynamic concepts can be applied to the analysis of systems independent of underlying mechanisms). To indicate the utility of such an approach, we consider the following substudy.

Experimentation in the areas of remote viewing and the determination of the state of a four-state electronic random stimulus generator have yielded results at levels of statistical significance $p < 10^{-6}$. As good as such results are from the standpoint of statistical significance, the information channel is imperfect, containing noise along with the signal. When one considers how best to utilize such a channel, one is led to the communication theory concept of the introduction of redundancy as a means of coding a message to combat the effects of a noisy channel.[1] We consider here the implementation of such a technique as a means of utilizing a noisy channel of the paranormal type as a practical communication system. A prototype experiment employing such techniques has proven successful.[2] The approach presented here constitutes both a pedagogical vehicle for the elucidation of the characteristics of the paranormal channel, and a developmental program potentially resulting in a communication channel of utilitarian value.

For our purposes we shall consider a message to consist of a sequence of alphabet characters, each character represented by a 5-bit code as shown in Table 7.* Each binary digit to be sent through the channel is to be encoded to combat channel noise, i.e., is to have added to it additional redundancy bits.

Efficient coding requires a compromise between the desire to maximize reliability and the desire to minimize redundancy.

One efficient coding scheme for such a channel is obtained by application of a sequential sampling procedure of the type used in production line quality control.[3] The adaptation of such a procedure to paranormal communication channels was considered first by Taetzsch.[4] The sequential

*Taking into account the uneven distribution of letter frequencies in English text, this code is chosen such that 0 and 1 have equal probability.

Table 7

5-Bit Code for Alphanumeric Characters*

E	00000	Y	01000
T	11111	G,J	10111
N	00001	W	01001
R	11110	V	10110
I	00010	B	01010
O	11101	Ø	10101
A	00011	1	01011
S,X,Z	11100	2	10100
D	00100	3	01100
H	11011	4	10011
L	00101	5	01101
C,K,Q	11010	6	10010
F	00110	7	01110
P	11001	8	10001
U	00111	9	01111
M	11000	.	10000

*Alphabet characters listed in order of decreasing frequency in English text. See, for example, A. Sinkov, Elementary Cryptanalysis--A Mathematical Approach, Random House (1968).

method gives a rule of procedure for making one of three possible decisions following the receipt of each bit: (1) accept "1" as the bit being translated, (2) reject "1" as the bit being transmitted (i.e., accept "0", or (3) continue transmission of the bit under consideration. The sequential sampling procedure differs from fixed-length coding in that the number of bits required per message bit is not fixed prior to transmission, but depends on the results accumulated with each transmission. The primary advantage of the sequential sampling procedure as compared with other methods is that, on the average, fewer bits per decision are required for an equivalent degree of reliability.

Use of the sequential sampling procedure requires the specification of four parameters, determined on the basis of the following considerations. Assume that a message bit (0 or 1) is being transmitted. In the absence of *a priori* knowledge, we may assume equal probability ($p = 0.5$) for the two possibilities (0,1). Therefore, from the standpoint of the receiver the probability of correctly identifying the bit being transmitted is $p = 0.5$ due to chance alone. An operative psi (paranormal) factor could then be expected to alter the probability of correct identification to a value $p = 0.5 + \psi$, where the parameter ψ satisfies $0 < |\psi| < 0.5$. (ψ may be positive or negative depending on whether the paranormal channel results in so-called psi-hitting or psi-missing.)

To indicate the design procedure, let us conservatively assume a baseline psi parameter $\psi_b = 0.1$ and design a communication system on this basis. The four parameters requiring specification in the sequential sampling procedure are:

1) q_1, the acceptable level of fraction misses for receipt of a given binary digit, say "1". For $\psi_b = 0.1$, $q_1 = 1 - p = 0.4$;

2) q_2, the unacceptable level of fraction misses for receipt of a given binary digit, say "1", indicating receipt of the alternative digit, say "0". For $\psi_b = 0.1$ and the symmetrical binary channel under consideration, we take $q_2 = 1 - q_1 = 0.6$;

3) α, the probability of rejecting a correct identification (Type I error). We shall take $\alpha = 0.01$.

4) β, the probability of accepting an incorrect identification (Type II error). We shall take $\beta = 0.01$.

With the parameters thus specified, the sequential sampling procedure provides for construction of a decision graph as shown in Figure 4. A cumulative record of receiver-generated responses to the target bit is compiled until either the upper or lower limit line is reached, at which point a decision is made to accept "0" or "1" as the bit being transmitted.

Channel reliability (probability of correctly determining message being transmitted) as a function of operative psi parameter ψ is plotted in Figure 5. As observed, the sequential sampling procedure can result in 90% or greater reliability with psi parameters on the order of a few percent. Figure 6 indicates the average number of trials required to come to a decision on a given message bit, a number which falls off rapidly as a function of increasing psi parameter ψ.

Implementation of the sequential sampling procedure requires the transmission of a message coded in binary digits. Therefore, the target space must consist of dichotomous elements, e.g, white and green cards as used in the experiments by Ryzl.[2]

In order to eliminate the deleterious aspects of repetition, and in order to take advantage of the observed tendency to recognize basic target elements even in the absence of comprehending the gestalt, the message information is coded in the form of projected slides viewed by the sender. Each slide represents one or the other group of dichotomized elements shown in Table 8 dependong on whether a "0" or "1" is to be sent. Based on receiver description detail, up to five bits may be transmitted per slide in accordance with the five dichotomies listed in Table 8.

In operation, a slide sequence corresponding to the target bit (0 or 1) is sent and the cumulative entries made as shown in Figure 4 (with up to five entries per slide) until a decision is made to accept either a "1" or "0" as the bit being transmitted. At a prearranged time the next slide sequence is begun, etc., until the entire message has been received.

From the results obtained in such an experiment, the channel bit rate can be ascertained for the system configuration under consideration. Furthermore, bit rates for other degrees of reliability (i.e., for other q_1, q_2, α and β) can be estimated by construction of other decision curves over the same data base, and thus provide a measure of the bit rate per degree of reliability. The procedures described here thus constitute a basis for specification of the characteristics of a paranormal channel under well-defined conditions, and provide for a determination of the feasibility of such a channel for communication purposes.

Table 8

Dichotomized Target Slides

"0"	"1"
black and white	color
indoor	outdoor
objects	people
stillness	motion
artificial	natural

Figure 4

SEQUENTIAL SAMPLING PROCEDURE

$q_1 = 0.4$, $q_2 = 0.6$, $\alpha = 0.01$, $\beta = 0.01$

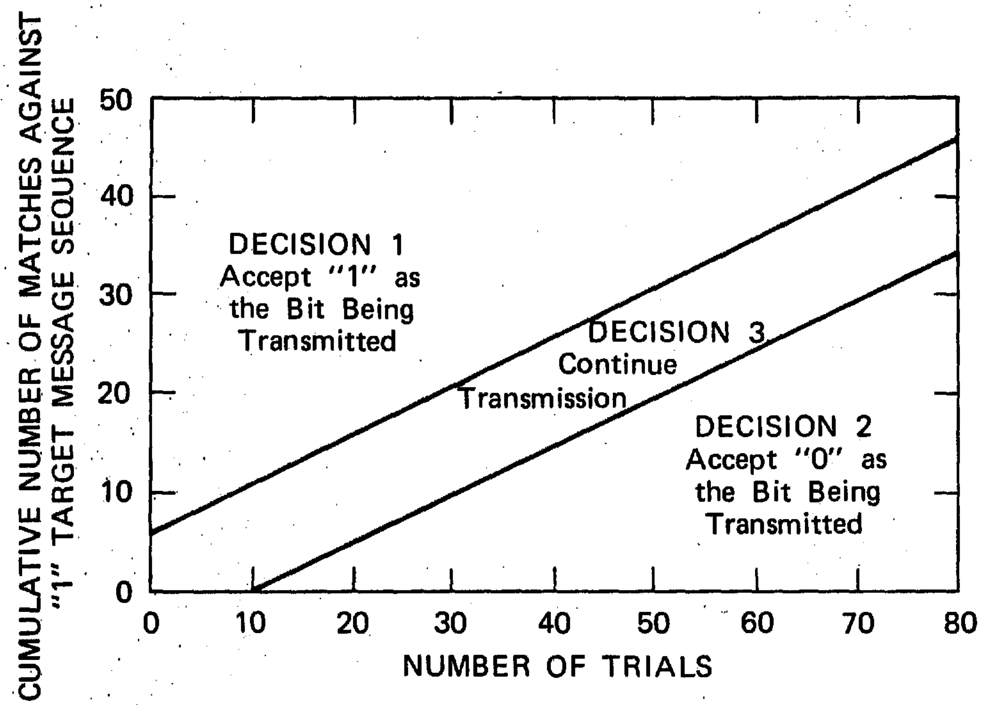


Figure 5

OPERATING CHARACTERISTIC CURVE FOR SEQUENTIAL SAMPLING PROCEDURE
$q_1 = 0.4$, $q_2 = 0.6$, $\alpha = 0.01$, $\beta = 0.01$

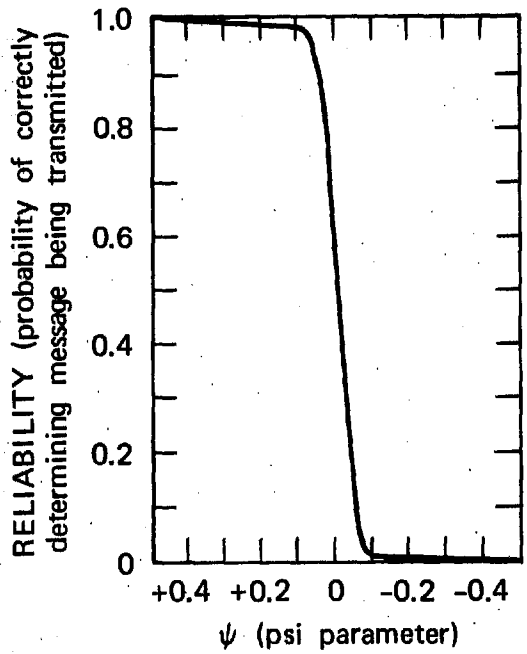
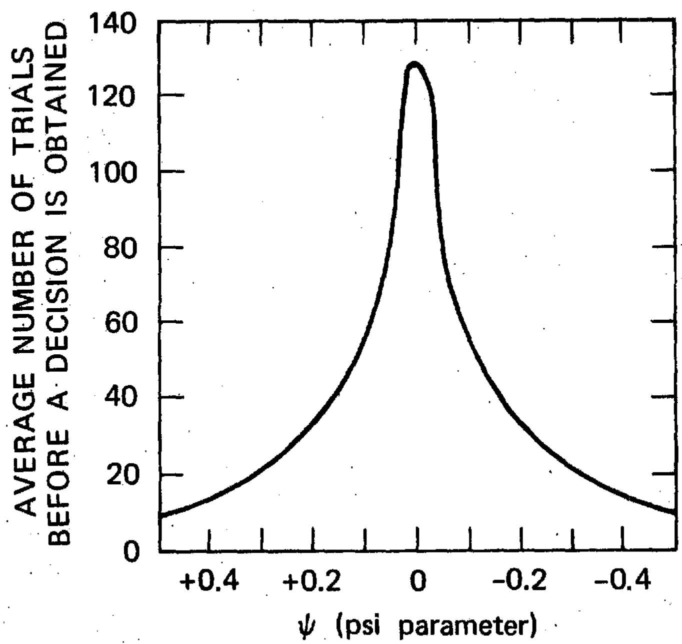


Figure 6

AVERAGE SAMPLE NUMBER FOR SEQUENTIAL SAMPLING PROCEDURE
q_1 = 0.4, q_2 = 0.6, α = 0.01, β = 0.01



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APPENDIX 1

PRECOGNITION — A MEMORY OF THINGS FUTURE?

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theories is quite different than the above picture would suggest. Instead of forbidding precognition from happening, these theories typically have sufficient symmetry to suggest that phenomena akin to precognition should occur in a manner qualitatively, although not necessarily quantitatively, similar to the occurrence of retrocognition. Indeed, phenomena involving a reversed time order of cause and effect are generally excluded from consideration on the ground that they have not been observed, rather then because the theory forbids them. This exclusion itself introduces an element of asymmetry into the physical theories, which some physicists have felt was improper, or required further explanation.[2] Thus, if such phenomena indeed occur, no change in the fundamental equations of physics would be needed to describe them. Only a change in the solutions used would be necessary.

The details of these aspects of physics relevent to this possibility will be given below. However, it is worth noting first that the occurrence of physical effects that propagate backwards in time may be related to precognition very indirectly. To see this, we note that the information about the past that is available to any person at a given time does not mainly consist of his sense data at that instant. Indeed, we usually do not think of sense data as giving information about the past, although strictly speaking it is the past we are observing, because of the finite time required for any known type of signals to propagate across space. Instead, our information about the past comes either from inferences we make from these observations, or through the poorly understood process we call memory, through which we can bring into our present awareness observations that we, or others, have made in the past, and which have somehow been stored in our brains.

A plausible analogy between information about the past and future would suggest that if information about the future is available to a person at all, the main source of it might well be observations that he or others will make in the future, and which will then be stored in his brain. It might be expected that whatever the mechanism of precognition, it could work more easily upon the future state of the percipients own brain than on the world outside. In other words, I am suggesting that precognition, if it exists, is basically a remembrance of things future, an analogy to memory, rather than a perception of future events, an analogy to sense perceptions of the very recent past. This suggestion has at least the merit of being fairly easy to test through simple experiments, or perhaps even through a careful literature search. I shall spell out below some of the simple consequences of this model for precognition, and how to test it. If it is correct, it would not directly indicate the physical mechanism for precognition, any more than the existence of memory indicates its physical mechanism. However, if it does turn out that memory can operate into the future as well as into the past, it would suggest that the symmetry of physical laws mentioned above is involved, and that physicists have been premature in discarding those solutions to their equations that describe reversed time order of cause and effect.

II. Time Symmetry of the Equations of Physics

The equations that describe the evolution in time of physical phenomena have a rather simple form according to relativity theory. A typical example, which illustrates the main points, is the wave equation in one space dimension, whose form is:

$$\frac{\partial^2 \phi}{\partial x^2} - \frac{1}{c^2} \frac{\partial^2 \phi}{\partial t^2} = \rho(x, t) \qquad (1)$$

where c is the velocity at which the waves move through space. In this equation, ϕ represents the amplitude of some wave phenomenon, and ρ a material source for the wave. For instance, ϕ might represent an electric field strength, and ρ the distribution of charge or current that produces the field. In a physical application of this equation, we would take ρ to be a prescribed function of space and time, and use the equation to calculate ϕ for all values of x and t. The values obtained for ϕ will depend on the value of ρ, but in a rather complex way. However, generally speaking, a change in ρ at one point in space and time, will lead to a change in ϕ at many points in space and time, in a way prescribed by the equation. A human being, or an instrument, sensitive to the value of ϕ in some region of space-time will therefore receive different impulses depending on the value of ρ in other regions of space-time, and hence will know something about what is happening in those other regions. Clearly, the relation between ρ and ϕ is a critical factor in determining what regions of space-time are accessible to a particular observer through measurement or sensing of the value of ϕ at his location.

Because equation (1) is a second order partial differential equation in the time, it has in general two sets of solutions. The particular form of equation (1) is such that one set can be obtained from the other set by the change of t into $-t$, in both ϕ and in ρ. We can study the character of these solutions by considering the simple case in which ρ is a transient disturbance, such as a light bulb that is turned on and off in a short period of time, and is limited to a small region of space. We shall call the point at which ρ is localized x_o, t_o. The solutions for this case can then be described as follows. One solution, called retarded, has $\phi = 0$ for all times earlier than t_o, everywhere in space. For times after t_o, ϕ is non-zero at the points $x = x_o \pm ct$. This corresponds to the generation of two pulses of radiation, each travelling outward from the source point at velocity c. An observer at a distance d from the point x_o would detect this radiation at a time t, later than t_o by d/c, the time taken for the radiation to travel the distance d. This retarded solution is the one generally chosen to represent the physical phenomena described by the wave equation.

The other solution, obtained from the retarded solution by letting $t \rightarrow -t$, is known as the advanced solution. It has the property that $\phi = 0$ for t later than t_o, everywhere in space. For t earlier than t_o, ϕ is non-zero at the points $x = x_o \pm ct$. This solution may be interpreted either as two pulses of radiation travelling outwards from the source, but backwards in time, or as two pulses coming from spatial infinity, but forwards in time, to meet at the source at t_o. With either interpretation of the advanced solution, there is associated with the disturbance at t_o, effects at times earlier than t_o, rather than later than t_o, as for the retarded solution. An observer at a distance d from the point x_o would detect the radiation corresponding to the advanced solution at a time t, earlier than t_o by d/c. In the case of an electromagnetic wave, travelling at the speed of light, this time is usually very short. When d corresponds to a distance of a few meters, d/c is about 1/100 of a microsecond, so that the advanced notice of a disturbance available in this way would not be very useful. If one considers waves propagating more slowly, such as sound waves, the advanced notice would be somewhat longer, but still too short to be directly useful for precognition. However, indirect effects of advanced waves are more promising, and will be discussed below.

Whatever use we could make of advanced waves, we must first ask whether they actually occur in the world, as against occurring as mathematical solutions to equations. The general solution to equation (1) is a linear combination of the retarded and advanced solutions, with unknown coefficients. As mentioned above, physicists have usually, although not always,[2] supposed that the coefficient of the advanced solution is zero, and only the retarded one is present. The reason for this is that advanced effects do not appear to occur, at least within some range of accuracy. The evidence for this is simple. If there were advanced effects comparable in size to retarded ones, many bizarre astronomical phenomena would be observed. For example, two images would be seen of a planet, or other astronomical objects, displaced by the distance that the object moves in twice the time it takes light to go from the object to earth. For the planet Mars, these images would be displaced by more than the planets apparent diameter, and would have been easily detected. Another example is that phenomena that occur at a well defined time at the place of origin, such as eruption of a solar prominence , would appear to occur twice in the same spot, once corresponding to the arrival of the advanced wave, and then later corresponding to the arrival of the retarded wave. Since these phenomena have not been reported by astronomers, we may conclude that advanced waves are not as strongly produced as retarded waves.

However, this does not imply that they are not produced at all. Conceivably, the ratio of strength of advanced and retarded waves is quite small, but not zero. This would not necessarily make the advanced waves useless for precognition, but would rather imply that precognition would not be as effective as ordinary perception, or as memory of the past, a conclusion for which there is ample evidence. Experiments to detect a relatively small amount of advanced light wave are not hard to imagine, and I have suggested some, that may soon be carried out by Prof. Riley Newman of the University of California. In the simplest such experiment, a light source is turned on at a time that is very sharply defined, say to within 10^{-9} seconds. A detector is placed at a distance of 10 meters from the source. The detector will ordinarily indicate the presence of the retarded wave after about 3×10^{-8} seconds have passed, corresponding to the transit time of the light over the 10 meters. If an advanced wave is also present, the detector would react to it at a time 3×10^{-8} seconds before the light is turned on, and this time is large enough that the advanced and retarded signals are easily distinguished. The consequence of not turning on the light after the advanced signal is detected is left to the reader to consider. Professor Newman believes that an advanced wave of intensity as little as one part in 10^{19} of the retarded wave could be detected in this way, so we should soon know if advanced electromagnetic waves occur. Advanced solutions for other kinds of wave motion, such as sound can be treated by similar mathematics. However, since these motions generally involve a real medium through which the wave moves, such as the atmosphere, it is unclear whether the interpretation would be the same. No experimental evidence about such advanced solutions is known to me.

III. A Model for Precognition

In the following, I shall outline a very speculative model for precognition that relies on advanced waves. The model is qualitative rather than quantitative, because it involves workings of the brain, where detailed physical information is unavailable. Yet I believe that model is sufficiently precise that it can easily be tested, providing that precognition can be demonstrated at all.

We assume that when some sensory input reaches the brain, an oscillatory variation of some internal patterns in the brain occurs, which is specific to the input. This oscillation persists for some period of time in at least part of the brain. When the person involved remembers the stimulus, what has happened is that the stored oscillatory pattern has influenced another part of the brain, bringing the memory into consciousness, or at least into something accessible to consciousness. Those familiar with the literature on memory will recognize that I have given a very sketchy description of one model for short term memory. There is some indication that long term memory involves rather different mechanisms.

Suppose now that the oscillatory pattern set up by an external stimulus has not only a retarded part, which propagates forward in time, but also an advanced part, propagating backwards in time. Although we do not know what equations this pattern would satisfy, it is not implausible that these equations are sufficiently similar to Eq. (1) that both types of solution exist. As in the case of light waves, the relative amounts of the two that are involved in an actual situation is not determined by the equation, and must be decided by experiment. I shall assume that the advanced part is non-zero, but presumably smaller than the retarded part, since precognition in practice is not a very effective way of getting information. Since the retarded part of the oscillation, which in this model allows memory of the past to occur, is known to persist for at least some time, without great attenuation, it is possible but not certain, that the advanced oscillation would be able to propagate for a corresponding time into the past before the stimulus occurs. So at least over this period of time, by a process similar to memory of the past, it could be possible for the advanced pattern to be brought into consciousness, so that the person involved would "remember" the future stimulus connected with the advanced pattern.

This in brief outline is the model for precognition that I wish to consider. There are several qualitative features of this model that can be simply recognized.

1). One can only "remember" things that one will eventually sense, or learn about through someone else's report. At least this is the case if one disregards the possibility of extrasensory information to be obtained at a later time and rememberd by this mechanism at an earlier time. While this neglect may not be entirely justified, it would seem a useful working hypothesis, since, in any event, the amount of information obtained by extrasensory means is small compared to the other sources I am considering.

2). If the retarded oscillatory pattern is correlated with short term memory, and if the latter has a relatively short term of operation, then we will expect that the advanced pattern would also have a similarly short range into the past. This would imply that precognition would be effective only for events in the not very distant future, perhaps on the scale of hours. Within this time period, precognition would be expected

5). If we omit from consideration the precognitive "chains" discussed under 2) above, it should not be possible for anyone to precognize about any event that will occur after that persons death, since no sensory input about that event could ever reach his brain. This conclusion is independent of the length of time that the advanced pattern can propagate into the past. It is consistent with one old legend to the effect that prophets cannot foretell their own death, but inconsistent with other legends. Of course, even if it is true that precognition cannot be used to foresee ones own death, other explanations are available to account for this, and it is therefore not a prediction very specific to the present model.

These properties that precognition should satisfy according to this model suggest a number of experimental tests of the validity of the model. Several of these tests will be discussed in the next section.

IV. Tests of the Future Memory Model of Precognition

In order for a model or explanation of any phenomena to have any value, it must be possible to confront it with experimental tests, or to make new observations of the phenomena about which the model makes specific predictions. This is not hard to do for the "future memory" model of precognition, provided always that we have fairly definite evidence that precognition is occurring in a specific instance.

The simplest aspect of the model to test is probably the prediction that a percipient can precognize only those things he will eventually know through ordinary perception. In order to test this prediction, one might first make a search of the literature on precognition to see whether accurate predictions have been made under conditions that preclude the obtaining of the information by the percipient at anytime after the prediction was made. If this turns out to be the case, it would be evidence against the model.

A more convincing test would involve an experiment designed for the purpose. The simplest version of this might be a precognition test in which the results are not ever revealed to the subject. A slightly more sophisticated version would involve a randomized decision pattern for revealing the data a fixed time after the trial. A comparison of the rate of success when the data are revealed as against those in which they are not could indicate the validity or invalidity of the model even if the level of precognition was low.

A possible objection to such experiments is that it is difficult to ensure that the object will never have access to the data at any future time. However, if point

2) above is correct, information obtained long after the trial has taken place would be useless, because of the decay of the advanced pattern at times long before it is established. A test of this point can also be carried out along the lines described above, if it is found that the basic effect exists. To do this, it would be necessary to give information about the data to the percipient at various time intervals after the trial, and investigate how the success rate of precognition would vary with this time delay. If the model is correct, there should be a dependence on time delay that is similar to the dependence of short term memory on the time lapse after the initiating stimulus. I am assuming here that there is no precognitive equivalent for long term memory, as the latter appears to involve a kind of static chemical storage, rather than an oscillating pattern in the brain. If this assumption were wrong, the particular test just described would give negative results, and precognition would be possible of any event up to the death of the percipient. This possibility, while it should be kept in mind, seems less likely to me.

Another testable aspect of the model is that the success rate of precognition should not depend on the spatial location, or any other physical attributes of the event being precognized. This could be tested by varying such attributes of the target, but keeping the information about it eventually furnished to the percipient, and the time advance, constant. Under these conditions the success rate would not be expected to vary, even if the target is at astronomical distances, or is extremely well shielded. These properties are in qualitative agreement with some anecdoted reports of precognition.

Finally, if the model is correct, we would expect precognitive ability to vary greatly from person to person, just as short term memory does. In fact, it is possible that the same people that have good short term memories would also be good at precognition, although that connection is not definite. Nevertheless, it would be worth testing people with good memories for precognitive abilities. Furthermore, it should be possible to improve precognitive ability by using the techniques that are used to improve short term memory. Probably, these techniques would improve the accessibility of the advanced pattern to the conscious mind, rather than affecting the absolute amount of advanced pattern generated by the event. The latter amount is probably determined by the basic laws by which the brain operates, and not subject to alteration by training.

I believe that if a series of experiments of the type described is carried out with a subject who has real precognitive ability, it would definitely decide whether the memory model of precognition is valid. Perhaps what is even more important, such experiments would furnish much new information about precognition, which would be useful in any case, even if the model should prove wrong.

V. Conclusions and Discussion

Since I believe in a materialist description of natural phenomena, including those involving human beings, I believe that if advanced effects occur in the human brain, they must occur elsewhere in the world, since brains are made of the same kind of matter as other objects are. It therefore appears plausible to me that if the future memory model of precognition is valid, that it should also be possible to detect advanced effects outside of the human brain, perhaps in the type of experiment that Dr. Newman plans to carry out. Conversely, if his experiments gave a positive result, showing that advanced effects do occur, it would lead more credence to the idea that they are what is involved in precognition. Even if the advanced effects are very small compared with the retarded ones, this would not rule out their playing a role in brain processes, provided that they are larger than the "noise" background. It would be interesting to estimate how small the ratio of advanced to retarded effects could be in the brain, and still have the advanced effects be useful; but I have not tried to do this.

Physicists have sometimes raised the objection that any occurrence of advanced effects in nature would lead to unavoidable paradoxes, and causal anomalies. Careful analysis of this question has not substantiated this claim,[2] but the question is not completely closed. However, it should be recognized that if such problems exist, they would also occur just from the existence of precognition, whatever the physical interpretation of the phenomenon. The analyses that have been carried out of possible causal anomalies due to advanced effects could usefully be applied to the precognition directly, rather than to its physical interpretation. I believe that the limited accuracy of precognition, and especially the impossibility of knowing whether a given precognition will turn out to be accurate until after the event has occurred, eliminate the possibility of such causal anomalies, but it would be worthwhile to carry the analysis through.

Finally, it would be interesting to follow up on a suggestion that is sometimes made, and investigate the extent to which all valid reports of extrasensory perception can be explained in terms of ordinary perception, combined with precognition. My impression is that many such reports can be so explained, but I do not know if they all can be. If it were possible to do so, this would mark a substantial advance in our understanding of these phenomena, and in linking them to other aspects of the physical world that we know better.

References

1. See for example, J. B. Rhine, The Reach of the Mind, (William Sloane Associates, New York, 1947).

2. For example, R. P. Feynman and J. A. Wheeler, Review of Modern Physics, 17, 157 (1945).

APPENDIX 2

Medical Evaluation (Raw Data)

Subject 2

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APPENDIX 3

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APPENDIX 4

Medical Evaluation (Raw Data)

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