Approved For Release 2000/08/07 : CIA-RDP96-00787R000700080001-8

Electro/77
Special Session
The State of the Art in Psychic Research

Electro77 Professional Program

New York, April 19-21, 1977

Copyright © 1977 Electro

Approved For Release 2000/08/07 : CIA-RDP96-00787R000700080001-8

Approved For Release 2000/08/07 : CIA-RDP96-00787R000700080001-8

POSSIBLE EEG CORRELATES TO REMOTE STIMULI UNDER CONDITIONS OF SENSORY SHIELDING

E. C. May,* Russell Targ, and H. E. Puthoff
Stanford Research Institute, Menlo Park, California 94025

ABSTRACT

We have investigated the ability of certain individuals to perceive remote (faint) stimuli at a noncognitive level of awareness. To investigate this we have looked for systematic changes in a subject's brainwave (EEG) production occurring at the same time as light flashes are generated on a random schedule in a remote laboratory. Although we have found in this investigation that significant correlations appear to exist between the times of light flashes and the times of brainwave alterations, we consider these data to be only suggestive, with a definitive result requiring further experimentation.

INTRODUCTION

In a number of laboratories evidence has been obtained indicating the existence of an as-yet-unidentified channel wherein information is coupled from remote electromagnetic stimuli to the human nervous system as indicated by physiological response, even though overt responses such as verbalizations or key presses provide no evidence for such information transfer. Physiological measures have included plethysmographic response[1] and EEG activity.[2,3] Kamiya, Lindsley, Pribram, Silverman, Walter, and others have suggested that a whole range of EEG responses such as evoked potentials (EPs), spontaneous EEG, and the contingent negative variation (CNV) might be sensitive indicators of the detection of remote stimuli not mediated by usual sensory processes.[4]

A pilot study was therefore undertaken at SRI to determine whether EEG activity could be used as a reliable indicator of information transmission between an isolated subject and a remote stimulus. Following earlier work of others, we assumed that perception could be indicated by such a measure even in the absence of verbal or other overt indicators.

To aid in selecting a stimulus, we noted that Silverman and Buchsbaum attempted, without success, to detect EP changes in a subject in response to a single stroboscopic flash stimulus observed by another subject.[5] Kamiya suggested that because of the unknown temporal characteristics of the information channel, it might be more appropriate to use repetitive bursts of light to increase the probability of detecting information transfer.[6] Therefore, in our study we chose to use repetitive light bursts as stimuli.[7-9]

PILOT STUDY AT SRI

In the design of the study it was assumed that the application of remote stimuli would result in responses similar to those obtained under conditions of direct stimulation. For example, when normal subjects are stimulated with a flashing light, their EEG typically shows a decrease in the amplitude of the resting rhythm and a driving of the brain waves at the frequency of the flashes.[10] We hypothesized that if we stimulated one subject in this manner (a putative sender), the EEG of another subject in a remote room with no flash present (a receiver), might show changes in alpha (8-13 Hz) activity, and possibly EEG driving similar to that of the sender, either by means of coupling to the sender's EEG, or by coupling directly to the stimulus.

We informed our subject that at certain times a light was to be flashed in a sender's eyes in a distant room, and if the subject perceived that event, consciously or unconsciously, it might be evident from changes in his EEG output. The receiver was seated in a visually opaque, acoustically and electrically shielded double-walled steel room located approximately 7 m from the sender's room.

We initially worked with four female and two male volunteer subjects. These were designated "receivers." The senders were either other subjects or the experimenters. We decided beforehand to run one or two sessions of 36 trials each with each subject in this selection procedure, and to do a more extensive study with any subject whose results were positive.

A Grass PS-2 photostimulator placed about 1 m in front of the sender was used to present flash trains of 10 s duration. The receiver's EEG activity from the occipital region (Oz), referenced to linked mastoids, was amplified with a Grass 5P-1 preamplifier and associated driver amplifier with a bandpass of 1-120 Hz. The EEG data were recorded on magnetic tape with an Ampex SP 300 recorder.

On each trial, a tone burst of fixed frequency was presented to both sender and receiver and was followed in one second by either a 10 s train of flashes or a null flash interval presented to the sender. Thirty-six such trials were given in an experimental session, consisting

*Consultant to SRI.

Approved For Release 2000/08/07 : CIA-RDP96-00787R000700080001-8

SS/3

of 12 null trails--no flashes following the tone--12 trials of flashes at 6 f.p.s. and 12 trials of flashes at 16 f.p.s., all randomly intermixed, determined by entries from a table of random numbers. Each of the trials consisted of an 11-s EEG epoch. The last 4 s of the epoch were selected for analysis to minimize the desynchronizing action of the warning cue. This 4-s segment was subjected to Fourier analysis on a LINC 8 computer.

Spectrum analyses gave no evidence of EEG driving in any receiver, although in control runs the receivers did exhibit driving when physically stimulated with the flashes. But of the six subjects studied initially, one subject showed a consistent alpha blocking effect. We therefore undertook further study with this subject. Of our six subjects, this one had by far the most monochromatic EEG spectrum. Figure 1 shows a typical occipital EEG spectrum of this subject.

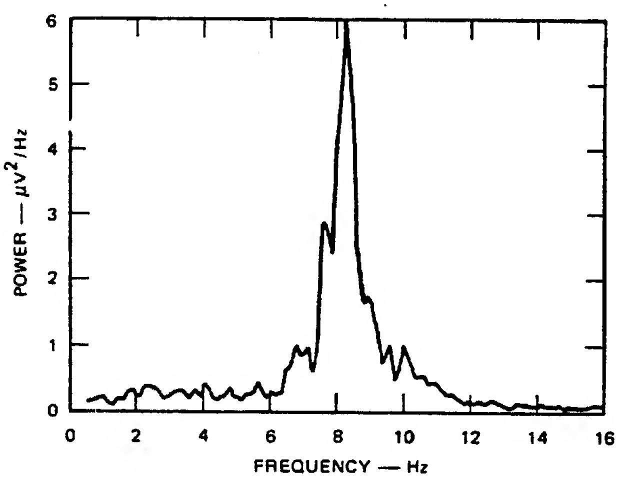

FIGURE 1 TYPICAL POWER SPECTRUM AVERAGED OVER TWENTY 8-SECOND EPOCHS

Data from seven sets of 36 trials each were collected from this subject on three separate days. This comprised all the data collected to date with this subject under the test conditions described above. The alpha band was identified from average spectra; then scores of average power and peak power were obtained from individual trials and subjected to statistical analysis. The final analysis showed that power measures were less in the 16 f.p.s. case than in the 0 f.p.s. in <u>all</u> seven sets of peak power measures and in <u>six</u> out of seven average power measures.

Siegel's two-tailed t approximation to the nonparametric randomization test[11] was applied to the data from all sets, which included two sessions in which the sender was removed. Average power on trials associated with the occurrence of 16 f.p.s. was significantly less than when there were no flashes ($t = 2.09$, d.f = 118, $P < 0.04$). The second measure, peak power, was also significantly less in the 16 f.p.s. conditions than in the null condition ($t = 2.16$, d.f. = 118, $P < 0.03$). The average response in the 6 f.p.s. condition was in the same direction as that associated with 16 f.p.s., but the effect was not statistically significant.

As part of the experimental protocol the subject was asked to indicate conscious assessment for each trial as to which stimulus was generated. The guess was registered by the subject via one-way telegraphic communication. An analysis of these guesses has shown them to be at chance, indicating the absence of any supraliminal cueing, so arousal as evidenced by significant alpha blocking occurred only at the noncognitive level of awareness.

Several control procedures were undertaken to determine if these results were produced by system artifacts or by subtle cueing of the subject. Low level recordings were made from saline of 12 kΩ resistance in place of the subject, with and without the introduction of 10 Hz, 50 μV signals from a battery-operated generator. The standard experimental protocol was adhered to and spectral analysis of the results were carried out. There was no evidence in the spectra associated with the flash frequencies, and the 10 Hz signal was not perturbed.

In another control procedure a five foot pair of leads was draped across the subject's chair (subject absent). The leads were connected to a Grass P-5 amplifier via its high impedance input probe. The bandwidth was set 0.1 Hz to 30 kHz with a minimum gain of 200,000. The output of the amplifier was connected to one input of a C.A.T. 400C "averager." Two-second sweeps, triggered at onset of the tone, were taken once every 13 seconds for approximately two hours, for about 550 samples. No difference in noise level between the fore-period and the onset of flicker was observed.

<u>REPLICATION STUDIES AT LANGLEY PORTER</u>

The next effort was directed toward replication by an independent laboratory of the original SRI study of EEG response to remote strobelight stimuli. Arrangements for replication were made with the Langley Porter Neuropsychiatric Institute, University of California Medical Center, San Francisco.

As a special precaution against the possibility of system artifacts in the form of electromagnetic pickup from the strobelight discharge or associated electronic equipment (e.g., through the power lines), SRI developed an entirely battery-operated package for use as a stimulus generator for the EEG experimentation. It consists of a battery-driven incandescent

Approved For Release 2000/08/07 : CIA-RDP96-00787R000700080001-8

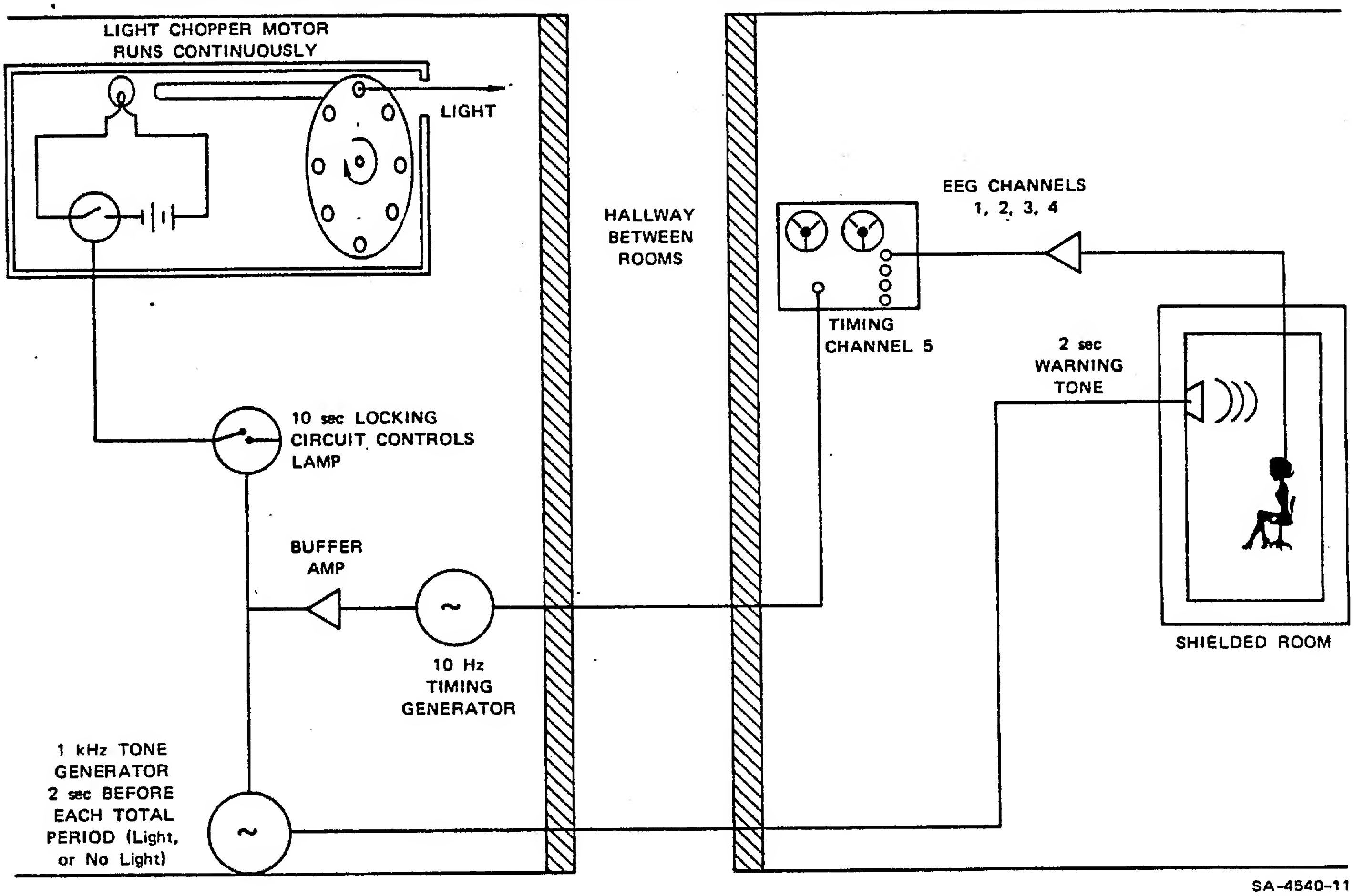

FIGURE 2 SCHEMATIC OF THE REMOTE SENSING EEG EXPERIMENT

lamp, whose CW output passes through a mechanical chopper continuously driven by a battery-driven motor as shown in Figure 2. A 10-Hz timing generator (computer triggered) controls the generation of a 1-kHz warning tone two sec before onset of the experimental period, and also drives a locking circuit that determines the presence or absence of the ten-sec light stimuli, again all battery operated. Thus everything on the left of the diagram of Figure 2 is battery operated and therefore independent of the power line system. Further, replacement of the arc-discharge strobelamp by an incandescent lamp eliminates the possibility of direct subliminal pickup of audio or electrical signals from possible transients associated with the arc discharge or associated electronics.

Description of the EEG Processor

A hardware single channel power spectrum analyzer was constructed from a commercial band-pass filter with corner frequencies of 9.0 and 12.0 Hz, and 48 dB down at 8.0 and 13.0 Hz. Analog multipliers convert the filter output to a signal proportional to in-band power. To confirm that this system is equivalent to the standard FFT analysis used in the pilot study, the analog data of the pilot study was reanalyzed, and the result was found to be consistent with the earlier analysis.

Experimental Protocol

Each experimental session consisted of 40 trials, 20 each for the 0 (no light) and 16 f.p.s. of the remote light stimulus. A trial is defined as a warning tone followed by a 10 second period consisting of a 2 second wait, and two 4 second data collection periods. The trial rate was one trial every 30 ± 1 seconds. The trial sequence was randomized subject to the following conditions: (1) in each group of 10 trials there were equal numbers of each condition, and (2) no more than three in a row of a single type were allowed. Seven 40 trial sequences were made according to this prescription and recorded separately on audio tape. During the session, trials were generated from one of these tapes and the sequence was unknown to the experimenters since the sequence tapes were

Approved For Release 2000/08/07 : CIA-RDP96-00787R000700080001-8

Approved For Release 2000/08/07 : CIA-RDP96-00787R000700080001-8

generated one month in advance of the experiments. As in standard EEG protocol, and in accordance with preestablished criteria, certain trials were deleted after the session for three reasons only: artifact, logic circuit failure, or abnormal EEG power. If a trial was rejected, a trial of the opposite stimulus condition was rejected at random from the particular set of 10 trials in question. If more than 10 trials of a given type were rejected from a session, the entire session was deleted. (This occurred twice in each experiment.)

Six channels of EEG and one logic channel taken from the sequence tape were recorded on a multiplexed FM analog tape recorder. The logic on the tape differentiated the trials between flashing and nonflashing conditions.

In pretesting the equipment, we ran the experiment using unselected subjects such as laboratory personnel, in order to test the adequacy of the experiment and to determine whether there were any correlated electronic or mechanical discharges from the apparatus. In 20 sessions of data acquisition, of 40 each (800 trials) there were no significant differences between the null and 16 Hz conditions.

RESULTS

Using the above protocol, two experiments were conducted during a three-month period. For half of the sessions, the subject was asked to press a button when she felt the light was flashing. For the six sessions (105 trials each for the 0 and 16 f.p.s. conditions when she was not asked to overtly indicate her feelings about the light, there was a slight decrease of in-band EEG power measured over the left occipital region of the brain. Similarly, for the six sessions (107 trials each for the 0 and 16 f.p.s. conditions) when she was asked to respond overtly, there was this time a significant decrease of in-band EEG power ($p \leq 0.037$, using an F ratio test derived from a two-way analysis of variance). In considering the experiment as consisting of the combined 212 trials in each stimulus condition regardless of the overt response contingency, we find a statistically significant decrease in in-band EEG power ($p < 0.011$, using F ratio test as above).

During the second experiment, three months later, a different contingency was added to determine if a "sender" was necessary to produce the effect we had observed earlier. For a given session, a random procedure (with equal trials) was used to determine if a person (called the "sender" person) would be looking at the photo-simulator. There was no one present with the photo-stimulator otherwise. For the 7 "non-sender" sessions (121 trials each for the 0 and 16 f.p.s. conditions) we find a statistically significant increase of in-band EEG power measured over the mid-occipital region of the brain ($p < 0.039$ using an F ratio test as above). During the "sender" sessions (123 trials in each stimulus condition) there was a slight increase of in-band EEG power. All together, there was a statistically significant increase of in-band EEG power when the 244 trials were analyzed regardless of "sender" condition ($p < 0.008$ using an F ratio test as above), and there was no significant difference found between "sender"/"no-sender" conditions.

For both experiments, we considered in-band EEG power for the 0-4 second and 4-8 second time periods independently to determine if the effects were time dependent. Although some of these isolated sub-intervals were statistically significant, no systematic relationship emerged. Thus the effect appears to be cumulative over the 8 seconds. The 0-8 second results are summarized in Table 1.

Table 1

SUMMARY OF RESULTS OF THE REPLICATION EXPERIMENTS SHOWING POWER MEANS AND STATISTICAL RESULTS FOR THE VARIOUS EXPERIMENTAL CONDITIONS

	Experiment I			Experiment II		
	Guessing Sessions	Non-Guessing Sessions	Combined	Sender Sessions	Non-Guessing Sessions	Combined
No light flash	957	704	832	854	766	810
Light flash	873	647	761	860	844	852
F ratio	4.39	2.20	6.47	0.017	4.33	7.03
df_1; df_2	1; 202	1; 198	1; 400	1; 232	1; 228	1; 460
$p \leq$	0.037	0.14	0.011	0.90	0.039	0.0083

Approved For Release 2000/08/07 : CIA-RDP96-00787R000700080001-8

DISCUSSION

Although our pilot experiment and the two replication studies all showed significant changes in EEG production correlated with the presence or absence of a remote light stimulus, the sign of the systematic change in power in the third study was opposite to that of the first two. We therefore undertook a detailed frequency analysis of the EEG data tapes from the last two experiments, since the pilot experiment had already been subjected to fast-Fourier-transform (FFT) analysis. We conjectured that the observed power change in these experiments might be the result of a very small frequency shift, which could become translated into a large amplitude change due to discriminator action of the alpha-band filter. In a chapter on alpha blocking, Kooi, in his *Fundamentals of Electroencephalography* says, for example, ". . . attentiveness is associated with a reduction in amplitude and an increase in average frequency of spontaneous cerebral potentials. . . The center frequency of the alpha rhythm may be influenced by the type of ongoing mental activity. Shifts in frequency may be highly consistent as two different tasks are performed alternately." The FFT analysis for the second experiment showed that the average peak EEG power occurred most often near 8 Hz, and thus fell slightly below the hardware summing window (±3 dB at 8.7-12.4 Hz) enhancing a possible discriminator effect. The FFT analysis further showed that there was an overall increase in frequency of peak power but the shift was statistically nonsignificant. This slight shift of 0.11 Hz could possibly account for the observed power increase due to the highly, nonlinear discriminator effects. In examining other portions of the spectrum for further effects, we found that systematic amplitude changes are highly dependent upon where in the frequency spectrum the power sum is taken. This is to be expected since almost all EEG phenomena are known to be strongly frequency dependent.

In the pilot study the frequency region for analysis was centered about the subject's dominant EEG output frequency with bandpass determined by the full width ten-percent power points. In the two replication studies we used hardware filters at this same frequency. FFT analysis showed clearly that if other filter bands had been chosen, significant correlations would not have been found. Thus, although our filter selection was made before the collection of any data, other experimenters might have reasonably chosen other criteria for frequency selection. Therefore, although we have found statistically significant evidence for EEG correlates to remote light flash stimuli, we consider these data to be only suggestive, with a definitive result requiring further experimentation.

REFERENCES

1. E. D. Dean, *Int. J. of Neuropsychiatry*, Vol. 2, p. 439, 1966.
2. C. T. Tart, *Int. J. of Parapsychology*, Vol. 5, p. 375, 1963.
3. T. D. Duane and T. Behrendt, *Science*, Vol. 150, p. 367, 1965.
4. R. Cavanna, Ed., *Psi Favorable States of Consciousness*. New York: Parapsychology Foundation, 1970.
5. *Ibid.*, pp. 143-169.
6. *Ibid.*, pp. 158-159.
7. R. Targ and H. Puthoff, "Information Transmission Under Conditions of Sensory Shielding," *Nature*, Vol. 252, No. 5476, pp. 602-607, October 18, 1974.
8. C. Rebert and A. Turner, "EEG Spectrum Analysis Techniques Applied to the Problem of Psi Phenomena," *Physician's Drug Manual*, Vol. 5, Nos. 9-12, Vol. 6, Nos. 1-8, pp. 82-88, January-December 1974.
9. H. Puthoff and R. Targ, "A Perceptual Channel for Information Transfer Over Kilometer Distances: Historical Perspective and Recent Research," *Proc. IEEE*, Vol. 64, No. 3, pp. 329-354, March 1976.
10. D. Hill and G. Parr, *Electroencephalography: A symposium on its Various Aspects*. New York: MacMillan, 1963.
11. S. Siegel, *Nonparametric Statistics for the Behavior Sciences*. New York: McGraw-Hill, 1956, pp. 152-156.

Approved For Release 2000/08/07 : CIA-RDP96-00787R000700080001-8