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## **EEG AND SPECT DATA OF A SELECTED SUBJECT DURING PSI TASKS: THE DISCOVERY OF A NEUROPHYSIOLOGICAL CORRELATE<sup>1</sup>**

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### **ABSTRACT**

Electroencephalograph (EEG) and Single-Photon Emission Computerized Tomography (SPECT) data were collected from Sean Harribance, a well documented psychic who has previously participated in laboratory research, while he was engaged in psi tasks. This data was independently collected from two different laboratories during 1997.

The primary goal of the EEG data collection was to determine the dominant electrocortical activity and its location while Sean participated in psi tasks. EEG data were collected from Sean in the following five psi tasks: two psychic readings from photographs, two runs of card guessing with standard ESP cards using the down through method, and one remote viewing trial. After removing any artifacts, the data for each condition were then spectrally averaged and topographic brain maps were computed which showed that while Sean was engaged in psi tasks, alpha was dominant bilaterally in the paraoccipital region, with alpha power being strongest in the right parietal lobe at electrode placement P4. A lack of alpha activity was seen in the frontal and temporal lobes.

For subsequent data analysis, Dr. Robert Thatcher at Applied Neuroscience Laboratory in Redington Shores, Florida edited and removed any artifacts from the raw EEG data collected from Sean during an eyes-closed baseline. He then analyzed the data for EEG coherence, phase, amplitude differences, and relative power, and compared these measures to the data in his Lifespan Reference EEG Data Base using the appropriate age-matched group. Results show deviations from the reference data base that are primarily bilateral, involving the occipital, temporal, and frontal regions. Sub-optimal neural function is indicated, especially in the frontal and temporal cortical regions.

Two Tc-99m SPECT ECD brain scans were completed with Sean in order to contrast a baseline resting condition with a psi task condition. The results indicate the areas of Sean's brain that were active while he was in the psi task condition and the baseline resting condition. The most pronounced finding was increased uptake of the tracer, relative to cerebellar uptake, in the paracentral lobule and in the superior parietal lobule of the right hemisphere only during the psi task condition. A mild decrease of function in the frontal, temporal, and thalamus regions is suggested by the lack of uptake of tracer in these areas during both conditions.

The consistency of the results across laboratories, equipment, experimenters, and research protocols suggests the existence of a neurophysiological correlate which is stable

across both time and conditions. It is hypothesized that the parietal cortex is activated while Sean is engaged in psi tasks as this part of the brain is attributed with visual search attention via the posterior attention network. Also, it is speculated that Sean's brain may be more highly developed or may function at a higher level in the parietal cortex to compensate for a lack of activity or sub-optimal neural function in the frontal and temporal cortical regions. The data presented is specific for Sean and may not be applicable to others. Future research with other selected subjects is needed in order to determine if these results can be replicated between subjects.

## INTRODUCTION

Examining the psychophysiological correlates of psi performance by using the electroencephalograph (EEG) to monitor brain waves is not a new concept in parapsychology. From the 1950s to the 1970s, several studies (Wallwork, 1952; American Society for Psychical Research, 1959; Cadoret, 1964; Morris & Cohen, 1969; Honorton, 1969; Stanford & Lovin, 1970; Honorton & Carbone, 1971; Honorton, Davidson, & Bindler, 1971; Morris, Roll, Klein, & Wheeler, 1972) were conducted exploring a possible relationship between alpha abundance and the proportion of correct guesses on an ESP task. The EEG results of these studies are contradictory, perhaps because of varying procedures, methods of data analysis, subject selection, etc. The most consistent finding within these studies, however, was a positive correlation between alpha abundance and high ESP scores, especially for subjects preselected for expertise at the production of one or both.

One of the subjects preselected for their ability to score high on the psi tasks that were employed in some of these EEG studies was Lalsingh "Sean" Harribance. In a study by Morris et al. (1972), EEG data were collected from Sean while he was engaged in the ESP task of guessing the sex of persons shown in concealed photographs. The overall results of this study were significant ( $p < 10^{-12}$ ), and a significant positive correlation was found between alpha abundance (percent-time alpha) and the proportion of correct choices ( $p < .05$ ). In addition, a comparison of alpha abundance just prior to runs and during runs showed that the alpha abundance tended to increase from pre-run to run on the high-scoring runs but not on the chance scoring runs ( $p < .03$ ).

In a second study by Morris et al. (1972), Sean was tested with standard ESP cards. As in the first study, overall results were significant ( $p < .001$ ) and there was a significant positive correlation between alpha abundance and the proportion of correct choices ( $p < .005$ ). However, a comparison of alpha abundance just prior to runs and during runs showed no significant differences in alpha abundance from pre-run to run on either the high-scoring runs or the chance scoring runs. It is notable that a ranking of the usable sessions (for EEG analysis) according to mean deviation from chance correlated significantly with a similar ranking of the sessions according to mean alpha abundance during the run (Spearman rho = + 1.00,  $p < .05$ , two-tailed). Morris et al. concluded that the relationship between high alpha abundance and high ESP scoring may therefore exist in part as a between-session phenomena.

Other interesting EEG results were found in an experiment by Kelly and Lenz (1976), in which Sean was tested with a binary electronic random number generator. Although the overall results of this experiment were nonsignificant, the results of MANOVA analyses indicated that the power spectrum of the pre-response EEG

appeared to discriminate, to a statistically significant degree, between hitting and missing responses. The main source of significant discrimination was excess power on missing trials, especially at the upper end of the frequency range associated with alpha (12-13Hz). It was independently significant in both hemispheres, and appeared somewhat larger on the right side.

Since the flourish of studies conducted over twenty years ago, very few EEG studies examining the psychophysiological correlates of psi have been published. In particular, no other EEG studies involving Sean Harribance have been published since that time. Within the last decade, most of the psi research using EEG has been reported and published by Norman S. Don, Bruce E. McDonough, and Charles A. Warren of the Kairos Foundation and the University of Illinois at Chicago.

Interestingly, Don and colleagues have found an increase of power, not only in the alpha range but in other frequency ranges as well, during psi-hitting runs. For example, in perhaps the first published psi study employing frequency-domain topographic mapping (Don, McDonough, & Warren, 1992), a selected subject performed 288 trials on a computer-controlled psi testing system called ESPerciser. The subject performed at chance level over all trials ( $p = .668$ , one-tailed exact binomial), but performed extremely high on Run 1 ( $p = .007$ ). Analyzation of the topographic maps of this run revealed a gradient in the theta, alpha, and beta bands, with minimum power at the left-lateral scalp increasing to a maximum at the right-lateral scalp. The authors also found in an earlier study with a different subject who participated in a clairvoyance card-guessing task that the EEG frequency spectrum indicated greater power in the theta and 40-HZ frequency bands over the right cerebral hemisphere for hit trials than for miss trials in a clairvoyance card-guessing task (McDonough, Warren, & Don, 1989).

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During the first week of April, 1997, Sean visited the Institute for Parapsychology in Durham, North Carolina to participate as a subject in a series of psi experiments conducted by Dr. John Palmer. Motivated by my own interest in examining the EEG data of selected subjects engaged in psi tasks, and unaware at this time of any specific EEG results obtained from Sean in previous psi research, I asked Sean if he would accompany me on Saturday to the EEG lab in Raleigh, North Carolina, the site of my doctoral internship in quantitative electroencephalography (QEEG).<sup>2</sup> Sean agreed and allowed me to collect EEG data from him during baseline conditions and psi tasks. This research was exploratory in nature and was not part of a formal experiment.

Following Sean's visit in April, I was invited to spend June 2 - 6, 1997 in Sudbury, Ontario, Canada with Dr. Michael Persinger, Dr. William Roll, and Dr. David Webster for neuropsychological and parapsychological testing of Sean. This research was a follow-up and extension of work done in 1996 by Persinger and Roll. In this paper, I will present the results of the QEEG data collected in Raleigh, North Carolina and subsequent further analyses of these data, along with the psychophysiological data collected in Sudbury. The results of other neuropsychological and parapsychological research conducted in Canada with Sean will be presented in a separate paper.

### **QEEG DATA COLLECTION (RALEIGH, NC; APRIL 5<sup>TH</sup>, 1997)**

As our time in the EEG lab was limited, data were collected for exploratory research purposes and not for hypothesis testing. Because it is important to have initial EEG assessment data as a baseline, I collected data from Sean under several different conditions and during several different tasks. The primary goal of the EEG data collection was to determine the dominant electrocortical activity and its location while Sean participated in psi tasks. In order to answer these same questions regarding brain activity during successful versus unsuccessful psi tasks, several days of testing, which we were not afforded, would have been required. Therefore, the results presented below indicate the type of electrocortical activity and its location while Sean was engaged in psi tasks irrespective of success.

## **Method**

### *EEG Recording Procedure*

An elastic skull cap made by Electro-Cap International, Inc., consisting of 19 electrodes prepositioned according to the International 10-20 system, was properly fitted on Sean. A forehead ground was used, and reference electrodes were applied to the left and right earlobes and linked. Electrode gel was applied to the electrodes and impedances for all electrodes were kept at approximately 5 K ohms. The sampling rate was 128/sec. The NeuroSearch-24 EEG System by Lexicor was used for data acquisition and related software was used for data editing and analysis.

### *Data Collection*

EEG data were collected from Sean in the following three conditions in order to obtain baseline data prior to the psi tasks: eyes-open baseline, eyes-closed baseline, and during the Bender Visual Motor Gestalt Test (Bender, 1938). The primary purpose of administering the Bender-Gestalt was to collect EEG data on Sean while he was drawing but not participating in a psi task. This data could then be used as comparative data for the remote viewing task in which Sean would be drawing during a psi task. The second reason for administering the Bender-Gestalt was to collect data on Sean's visual motor abilities and brain function. The results obtained from the Bender-Gestalt for the latter purpose will not be discussed in this paper.

After baseline data were collected, data were collected on Sean during the following five psi tasks: two psychic readings from photographs, two runs of card guessing with standard ESP cards using the down through method, and one remote viewing trial. One to five minutes of data were collected for each different condition, depending upon the amount of time it took to complete each task. The raw EEG records were visually inspected and any epochs containing eye movement or other artifacts were deleted. Of the remaining epochs, fifteen were chosen from each condition in order to make the analyses across conditions comparable. The data for each condition were then spectrally averaged and topographic brain maps were computed.

## **Results**

The topographic brain maps (see Figure 1) demonstrate that while Sean was engaged in psi tasks, alpha was dominant bilaterally in the paroccipital region, with alpha power being strongest in the right parietal lobe at electrode placement P4 (see Figure 2). A lack of alpha activity can be seen in the frontal and temporal lobes. This finding is consistent across all psi tasks except for the remote viewing task. During this task, alpha power was strongest in the left occipital region and the alpha activity in general extended midline towards the frontal lobes. More alpha was present during the remote viewing than during the Bender-Gestalt. Slightly more alpha activity can be seen in the temporal lobes and in the frontal lobe in the remote viewing task relative to the other psi tasks.

Sean's electrocortical activity during the psi tasks differed from the activity occurring during baseline conditions. Most notably, during the eyes-open baseline, beta was dominant in the left occipital region and alpha power was strongest in the frontal region. During the Bender Visual Motor Gestalt Test, beta was dominant in the right temporal lobe and in the left occipital region, with alpha being present in the left occipital and frontal central regions.

(Figure 1 missing from original paper)

Figure 1. Topographic brain maps of the three baseline conditions (top row) and three psi task conditions (bottom row). Each topographic map depicts a top-down view of the head with the nose pointing forward. The numbers 1 and 2 point to the areas where alpha power is strongest, with areas designated by a 1 having more power than areas designated by a 2. The numbers 3 and 4 point to areas where alpha power is the least, with areas designated by a 4 having less power than those designated by a 3.

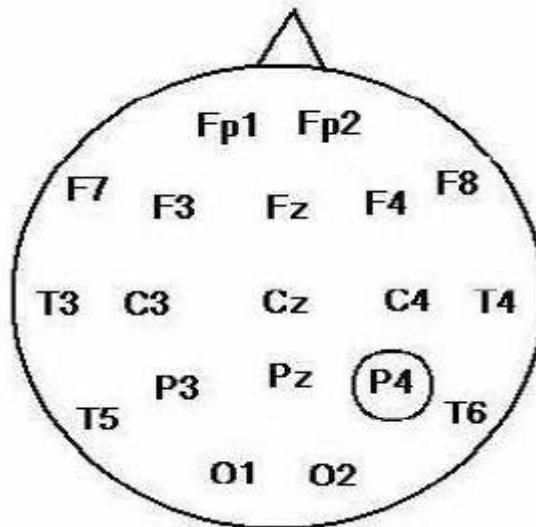


Figure 2. Schematic of the International 10-20 electrode placement system with electrode placement P4 (right parietal lobe) circled. This schematic could be superimposed upon the topographic maps in Figure 1 as a reference to electrode placement.

The topographic maps of the eyes-closed condition are similar to the topographic maps of the psi tasks, perhaps because Sean reported that when his eyes were closed visual images spontaneously entered his mind as they did during the psi tasks. In

general, more frontal alpha activity can be seen in the eyes-closed baseline than in the psi task conditions.

It should be noted that throughout all eight conditions, there is a lack of electrocortical activity in the left temporal lobe. This lack of activity was not due to a faulty electrode.

### **SUBSEQUENT EEG ANALYSIS (REDINGTON SHORES, FL; OCTOBER 7<sup>TH</sup>, 1997)**

In October, 1997, I sent the raw EEG data files on Sean that I collected in April to Dr. Robert Thatcher at Applied Neuroscience Laboratory in Redington Shores, Florida for subsequent analysis and comparison with his normative Lifespan Reference EEG Data Base (Thatcher, 1995). I felt that it was important to have Sean's EEG data compared to that of the normative data base so that the severity and anatomical location of any abnormalities could be evaluated.

Dr. Thatcher edited the raw EEG data from the eyes-closed baseline condition and removed any artifacts. He then analyzed the data for EEG coherence, phase, amplitude differences, and relative power, and compared these measures to the data in his Lifespan Reference EEG Data Base using the appropriate age-matched group.

### **Results**

Results of the analysis and comparison of Sean's EEG data with the Lifespan Reference Data Base show deviations from the reference data base that are primarily bilateral, involving the occipital, temporal, and frontal regions. Sub-optimal neural function is indicated, especially in the frontal and temporal cortical regions. Results of EEG coherence analysis indicate that there may be reduced functional connectivity, especially in the bilateral central and frontal regions.

### **EEG DATA COLLECTION (SUDBURY, ONTARIO, CANADA; MAY 27<sup>TH</sup>, 1996)**

Three days of neuropsychological, cognitive, and personality assessment were completed with Sean in order to discover any potential anomalies that might help explain the psi phenomena that Sean experiences. At the end of the first test day, Sean's electrocortical activity was measured during a period of relaxation, as clinically relevant neuroelectrical anomalies are often displayed during rest periods when they have been preceded by maintained psychological activity. The EEG measures taken are indices of attention and regional anomalies, and they are not equivalent to a complete neurological EEG assessment.

### **Method**

While seated in a comfortable chair, silver-disc electrodes were attached to Sean's scalp with EC-2 cream. Bipolar recordings of electrocortical activity from the occipital, temporal, and frontal regions were collected for 20 minutes. During the next 10 minutes, intrahemispheric and interhemispheric electrical activity was measured between

the left and right hemisphere for temporooccipital, frontotemporal, and frontooccipital positions.

## Results

Beta frequency was dominant rostrally over the prefrontal, temporal, and occipital lobes, while a near-continuous train of alpha rhythms dominated the posterior regions. Because Sean was frequently vocalizing, fast beta activity dominated the temporal and frontal regions. No evidence of classical epileptiform signatures was found.

Bilateral interhemispheric comparisons in the temporofrontal regions were coherent and dominated by fast beta activity. Occipitotemporal comparisons were anomalous, as the left hemisphere displayed more frequent episodes of slow alpha rhythms than did the right hemisphere. A marked elevation of activity over the right hemisphere was suggested by a conspicuous superimposition of a higher frequency source upon the fundamental (alpha).

Interhemispheric comparisons in the frontooccipital regions showed relatively coherent trains of alpha rhythms.

## SPECT BRAIN SCANS (SUDBURY, ONTARIO, CANADA; JUNE 4<sup>TH</sup> & 6<sup>TH</sup>, 1997)

Function in the brain can be detected by Single-Photon Emission Computerized Tomography (SPECT). With SPECT, a commercially available tracer which emits photons is injected or inhaled. The emitted photons are detected and the information gained provides a three dimensional graphic image of metabolic activity within the brain. It is inferred that the active areas of the brain are the functional areas associated with the tasks performed while the tracer is being absorbed.

## Method

Two Tc-99m SPECT ECD brain scans were completed with Sean in order to contrast a baseline resting condition with a psi task condition. For both scans, Dr. Webster injected Sean with a tracer prior to the psi task condition and the baseline resting condition. This allowed the tracer to be absorbed by the brain during the activities assigned to the two different conditions. During the psi task condition on June 4th, Sean gave a psychic reading of about 45 minutes duration to a patient of Dr. Persinger. During the resting baseline condition on June 6th, Sean relaxed for about an hour. After each condition, Sean was taken to Sudbury General Hospital for the SPECT brain scan, which took about 45 minutes to complete.

## Results

The results of the SPECT brain scan indicate the areas of Sean's brain that were active while he was in the psi task condition and the baseline resting condition. The most pronounced finding was increased uptake of the tracer, relative to cerebellar uptake, in the paracentral lobule and in the superior parietal lobule of the right hemisphere during the psi task condition. This was not found during the baseline condition. Also, a small

focal defect in approximately Area 44, adjacent to the Sylvian fissure, was seen during the psi task condition but not during the baseline condition. The significance of this small focal defect is unknown.

Other relevant findings include some mildly decreased uptake of the tracer in the left basal ganglia, left thalamus region, midline thalamus area, and in the frontal areas of the brain in both conditions. These results suggest that there may be some mild decrease of function in these areas. Both conditions were also associated with a decrease in the uptake of the tracer (hypoperfusion) bilaterally in the temporal regions. This hypoperfusion was more pronounced in the left temporal region than the right, with slight relative improvement in the right during the baseline condition.

## **DISCUSSION**

Despite the fact that the data presented in this paper are from several different studies that have been conducted by different experimenters in different laboratories over the years, a consistent trend in the data is present throughout. This consistency suggests a stable neurophysiological correlate which exists between cerebral activity and participation in psi tasks by the selected subject Sean Harribance. The most important finding within these studies was an increase of activity in Sean's right parietal lobe while he was engaged in a psi task as compared to when he was not. Specifically, the QEEG data collected in Raleigh showed an increase in alpha power in the right parietal lobe at electrode placement P4 while Sean was engaged in psi tasks, and the SPECT data showed increased metabolic activity in the right parietal region during the psi task condition.

Data is not available at this time to demonstrate that psi actually occurred during the psi task conditions while QEEG and SPECT data were collected. However, while Sean was engaged in the psi tasks, alpha was dominant. One may speculate that psi was indeed present as previous research with Sean (Morris et al., 1972) indicates the presence of alpha during high ESP scores.

Nonetheless, it has been demonstrated that there is an increase of activity in Sean's right hemisphere in the parietal region while he is engaged in psi tasks. An important question is why this area of the brain would be activated during psi tasks. The answer may be that the region of the brain that is involved in visual search attention is located in the parietal cortex. When a person is attending to a location in space, the posterior attention network, which is located in the parietal cortex, is activated (Posner & Rothbart, 1991). Regional cerebral blood flow studies show increased blood flow, indicative of neural activity, in the parietal cortex when people attend to spatial locations (e.g., Corbetta et al., 1991). Perhaps psi is attended to and processed in the brain in the parietal cortex via the posterior attention network.

Also, it may well be that Sean's brain has areas that function at a higher than normal level to compensate for areas that function sub-optimally. Data from the SPECT, QEEG and from the Lifespan Reference Data Base comparison indicate a lack of activity or sub-optimal neural function in the frontal and temporal cortical regions in Sean's brain. Perhaps an increase of activity and function in the parietal lobe helps compensate for these less functional areas.



In summary, the results of this paper show that a neurophysiological correlate exists for the selected subject Sean Harribance while he is engaged in psi tasks in the laboratory. The data presented is specific for Sean and may not be applicable to others. Future research with other selected subjects is needed in order to determine if these results can be replicated between subjects.

## NOTES

1. The research in Canada was supported by the Sean Harribance Institute for Parapsychological Research.
2. Thanks to Dr. Dan Chartier at Medical Biofeedback Services, Inc. for the use of EEG equipment.

## REFERENCES

- American Society for Psychical Research, Research Committee. (1959). Report of the Research Committee for 1958. *Journal of the American Society for Psychical Research*, 53, 69-71.
- Bender, L. (1938). A Visual Motor Gestalt Test and its clinical use. *American Orthopsychiatric Association Research Monograph*, No. 3.
- Cadore, R. J. (1964). An exploratory experiment: Continuous EEG recording during clairvoyant card tests. *Journal of Parapsychology*, 28, 226.
- Corbetta, M., Meizin, F. M., Shulman, G. L., & Petersen, S. E. (1991). Shifting attention in space, direction versus visual hemifield: Psychophysics and PET. *Journal of Blood Flow and Metabolism*, 11, 909.
- Don, N., McDonough, B., & Warren, C. (1992). Topographic brain mapping of a selected subject using the ESPerciser: A methodological demonstration and an exploratory analysis. *Proceedings of the Parapsychological Association 35th Annual Convention*, Las Vegas, NV, 36-50.
- Honorton, C. (1969). Relationship between EEG alpha activity and ESP card-guessing performance. *Journal of the American Society for Psychical Research*, 63, 365-374.
- Honorton, C., & Carbone, M. (1971). A preliminary study of feedback-augmented EEG alpha activity and ESP card-guessing performance. *Journal of the American Society for Psychical Research*, 65, 66-74.
- Honorton, C., Davidson, R., & Bindler, P. (1971). Feedback augmented EEG alpha, shifts in subjective state, and ESP card-guessing performance. *Journal of the American Society for Psychical Research*, 65, 308-323.
- Kelly, E. F., & Lenz, J. (1976). EEG correlates of trial-by-trial performance in a two-choice clairvoyance task: A preliminary study. In J. D. Morris, W. G. Roll, & R. L. Morris (Eds.), *Research in Parapsychology 1975* (Vol. 4, pp. 22-25). Metuchen, N.J.: The Scarecrow Press, Inc.
- McDonough, B., Warren, C., & Don, N. (1989). EEG frequency domain analysis during a clairvoyance task in a single-subject design: An exploratory study. In L. A. Henkel, & R. E. Berger (Eds.), *Research in Parapsychology 1988* (pp. 38-40). Metuchen, N.J.: The Scarecrow Press, Inc.
- Morris, R. L., & Cohen, D. A. (1969). A preliminary experiment on the relationship among ESP, alpha rhythm and calling patterns. *Proceedings of the Parapsychological Association*, 6, 22-23.
- Morris, R. L., Roll, W. G., Klein, J., & Wheeler, G. (1972). EEG patterns and ESP results in forced-choice experiments with Lalsingh Harribance. *Journal of the American Society for Psychical Research*, 66(3), 253-268.

- Posner, M. I., & Rothbart, M. K. (1991). Attentional mechanisms and conscious experience. In D. Milner & M. Rugg (Eds.), *The neuropsychology of consciousness*. Orlando, FL: Academic Press.
- Stanford, R. G., & Lovin, C. (1970). EEG alpha activity and ESP performance. *Journal of the American Society for Psychological Research*, 64, 375-384.
- Thatcher, R. W. (1995). Lifespan Reference EEG Data Base. *The Use of QEEG Data Bases in the Evaluation and Treatment of Mild Traumatic Brain Injuries*. Self-published manual.
- Wallwork, S. C. (1952). ESP experiments with simultaneous electroencephalographic recordings. *Journal of the Society for Psychological Research*, 36, 697-701.