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# EEG AND SPECT DATA OF A SELECTED SUBJECT DURING PSI TASKS: THE DISCOVERY OF A NEUROPHYSIOLOGICAL CORRELATE[1]

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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.

[1] The research in Canada was supported in part by the Sean Harribance Institute for Parapsychology Research (SHIPR), Houston, Texas. Transportation to Canada for Cheryl Alexander was provided by the Laboratories for Fundamental Research.

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.$^{TM}$ 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).[2] 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 5TH, 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 pre-positioned 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*

[2] Thanks to Dr. Dan Chartier at Medical Biofeedback Services, Inc. for the use of the EEG equipment.

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 paraoccipital 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. 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.

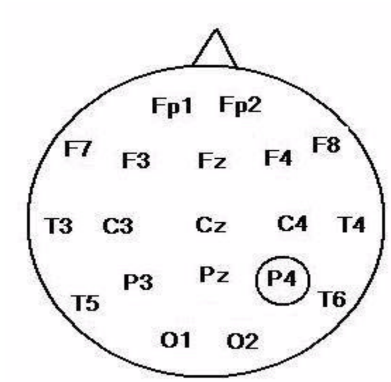


Figure 2. Schematic of the International 10-20 electrode placement system with electrode placement P4 (right parietal lobe) circled. This schematic could be superimposed upon the topographic maps in Figure 1 as a reference to electrode placement.

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 7TH, 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$^{TH}$, 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-continuos 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 4TH & 6TH, 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 blow 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.

## 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.*

Cadoret, 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 Psychical 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 Psychical Research, 36*, 697-701.

# A STUDY OF THE FEATURES OF OUT-OF-BODY EXPERIENCES IN RELATION TO SYLVAN MULDOON'S CLAIMS[1]

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## ABSTRACT

In this paper we will put to test some ideas expressed by "astral projector" Sylvan Muldoon in his 1929 book, *The Projection of the Astral Body* (with H. Carrington). Based on his numerous OBEs Muldoon wrote about OBE patterns he assumed to be universal. These patterns consisted of lack of thought-clarity and motor coordination while Muldoon was close to the body (under 8 feet), and the experience of shock to the body on rapid and sudden returns. We collected 88 OBE questionnaires from appeals in newspapers and magazines. Based on Muldoon's experiences and claims it was predicted that we would find a positive and significant correlation between distance from the physical body during the OBE and a measure of thinking and mental clarity, and a similar positive relationship between the distance measure and a measure of control of movements. In addition, we also expected higher levels of thinking and mental clarity and control of movements at specific distances from the body (below and over eight feet from the body). Finally, we predicted a higher frequency of reports of shocks to the body at the end of the experience if the return to the body was sudden and rapid than when returns were slow and gradual. The hypothesis of a positive correlation between rate of control of movements during the OBE and distance from the physical body was confirmed. Similarly, the prediction of a positive relation between clear thinking/mental clarity (one variable) and distance was also confirmed. If the distances were limited to those less than five feet from the body and those over 15 feet from the body, which clearly include those below and above the eight feet range from the body emphasized by Muldoon for control, the difference was significant. The results for thinking and mental clarity and for shocks to the body were not significant. Work such as this has the potential of dispelling myths, of testing the experiences of individuals who have been very influential in the occult and popular literature against the experience of others. This line of work allows researchers to be responsible to the social needs of people who are interested in these issues by producing research that is

[1] We wish to thank the Institut für Grenzgebiete der Psychologie und Psychohygiene, the Parapsychology Foundation, and the Society for Psychical Research for their financial support.
We dedicate this paper to the memory of Karlis Osis, whose explorations of OBE features, and whose courageous studies of the "unconventional" within an unconventional discipline, has inspired us to conduct work such as the study reported in this paper.

relevant to their concerns, and which speaks to the materials they read and believe.

## INTRODUCTION

In a recent paper one of us (C.S.A.) justified a research program designed to study out-of-body experiences (OBEs) in depth (Alvarado, 1997). This research program pays attention to the features of the experience. These features, consisting of floating sensations, seeing lights, traveling to distant places, seeing the physical body, perceiving oneself in a body similar to the physical or with no body at all, and having feelings of elation, among others, have been documented over the years in surveys and case collections (e.g., Alvarado, 1984; Crookall, 1961, 1964; Giovetti, 1983; Green, 1968; Muldoon, 1936; Muldoon & Carrington, 1951; Osis, 1979; Poynton, 1975; Twemlow, Gabbard, & Jones, 1982). This program of research is based on the assumption that there is much to learn by studying OBE features beyond their incidence. One approach is to see if the frequency of some features of the OBE is affected in some way by their interaction with such variables as the mode of OBE induction, whether the circumstances surrounding the experience were near-death, other OBE features, or demographic circumstances (Alvarado, 1984, 1997; Alvarado & Zingrone, 1997; Gabbard, Twemlow & Jones, 1981; Irwin, 1985).

One way to explore issues of this sort further is by studying the OBE patterns of frequent OBErs, and to test if the experience characteristics of frequent OBErs can be found in other individuals as well. The literature on this subject is rich, as seen in the writings of Fox (1939), Harary (1978), Monroe (1971), Muldoon (Muldoon & Carrington, 1929), Turvey (1911), Vieira (1986), and many others. Some of these writings are very influential in that they shape beliefs about OBEs in the popular culture. As we have argued elsewhere (Alvarado & Zingrone, 1996a, 1996b) we have a responsibility as researchers to explore this popular and occult literature to determine whether the prescriptions and rules promoted in this type of literature can be generalized to other individuals. It is our belief that scientific research into experiences like OBEs is necessary because of the tendency for the general public to initiate practices and form beliefs on the basis of these books, steps which may or may not be warranted, which may or may not be psychologically adaptive. In this paper we will focus on the writings of “astral projector” Sylvan Muldoon.

Muldoon was a well-known gifted individual who had thousands of OBEs throughout his life (for biographical information see Blackmore, 1982; and Rogo, 1978). His writings are among the most influential in OBE history as they speak to the experience of those who have had many OBEs. Muldoon is best known for his book, *The Projection of the Astral Body* (Muldoon & Carrington, 1929), co-authored with psychical researcher Hereward Carrington, in which Muldoon described his own OBEs in detail. Even to this day, the book is frequently cited as an exemplar of OBE autobiographical accounts (e.g., Alvarado & Zingrone, 1997; Blackmore, 1982; Irwin, 1985; Mishlove, 1993). In later books Muldoon (1936; Muldoon & Carrington, 1951) compiled other individuals’ OBEs and commented on the significance of them. In *The Projection of the Astral Body* Muldoon derived some “principles” from his many experiences (Muldoon &

Carrington, 1929). For example, for Muldoon there was mental confusion and difficulty in controlling the movements of the OBE body when he felt himself to be close (within 8 feet or so) to his physical body. In addition, he claimed that feelings of shock to the physical body on return were more frequent when the return occurred suddenly than when it occurred gradually. (This particular relationship was found in a previous study by the present authors [Alvarado & Zingrone, 1997]). Because Muldoon described his experiences and derived "principles" from them in a more precise and consistent way than other individuals who have written autobiographical accounts of their OBEs (e.g., Fox, 1939; Monroe, 1971; Harary, 1978; Turvey, 1911; see also the reviews of autobiographical accounts of Blackmore, 1982; Irwin, 1985; and Rogo, 1978), we used some of his descriptions and ideas to generate hypotheses to see if his experiences may be generalized to the experiences of other individuals. Consequently, in the present study we predicted more mental clarity and motor control in experiences in which the reported separation from the physical body was greater than the range specified by Muldoon, as compared to those experiences that occurred close to the body. In addition, we expected a positive and significant correlation between distance from the physical body during the OBE and a measure of thinking and mental clarity, and a similar positive relationship between the distance measure and a measure of control of movements (2 predictions). We also hypothesized a higher frequency of reports of shocks to the body at the end of the experience if the return to the body was sudden and rapid than when returns were slow and gradual.

## METHOD

### Participants

The participants selected themselves on the basis of responses to queries for OBEs published in a variety of sources. Usable replies for the OBE questionnaire were received from 88 individuals. Because not everyone answered all the questions the demographics and other questions are not always based on the whole sample. Of the 87 who provided information about their sex, 62% percent were female and 38% were male. Their ages ranged from 20 to 80 with a mean of 51.76 (N = 86, SD = 14.67). The mean age at the time of the OBE was 33.12 (N = 81, Range: 5-78, SD = 14.98). Out of 87 respondents to the question about nationality, 88% described themselves as from Great Britain. The rest claimed they were Americans (8%), Italians (2%), Sri Lankans (1%), and New Zealanders (1%). Out of 71 participants who indicated where in Great Britain they were born, 61% said Scotland and 39% said England. Other demographic details will be described in a different article now in preparation.

A second questionnaire was mailed at a later date asking about parapsychological experiences and including some psychological scales, but this part of the study is not relevant for the present analyses and will be reported elsewhere.

### Procedure

Several letters were sent to newspapers in Scotland which asked people who have had OBEs, and who were willing to participate in a study involving answering questionnaires, to get in contact with the researcher. Letters were also published in spiritualist and psychical research periodicals from Great Britain and posted to two on-line discussion groups of parapsychological topics on the Internet. Detailed information about these publications is available from the authors.

All the call for cases included the following question: "Have you ever had an experience in which you felt that 'you' were located 'outside of' or 'away from' your physical body; that is, the feeling that your consciousness, mind, or centre of awareness was at a different place than your physical body?" Potential respondents, if they could answer yes to the question and were willing to complete questionnaires, were instructed to write to C.S.A. at the Department of Psychology of the University of Edinburgh. They were assured that all communications would be kept confidential.

#### *Questionnaire*

The OBE questionnaire had 16 pages (a copy may be obtained from the first author). It started with demographic questions (11 items), and with a question about where or how the participant heard about or came in contact with, the project. After this there were two questions about frequency and level of control of OBEs. The participant was asked to describe his or her most recent OBE, or the only one they had experienced. A whole page was provided for this but they were told that additional paper could be used if necessary. After the description, respondents were told that the questions should be answered in terms of the experience described. The rest of the questionnaire consisted of questions about the circumstances surrounding the experience, about visual experiences, auditory experiences, kinesthetic sensations, cognitive and emotional aspects, and other aspects. Many of the questions had several sections that asked for details about the particular claims.

#### *Analyses*

The data was entered into the StatPac Gold 4.5 statistical software program. Frequency-based analyses were assessed using the chi-square test. Analyses based on scores were analyzed with Spearman Rank Order correlations, and with Mann-Whitney U Tests. Effect sizes (r) for the z values generated by the Mann-Whitney U test were calculated using the equation presented by Rosenthal (1991, p. 19): $z / \sqrt{N}$.

## RESULTS

Tables 1 and 2 present the descriptive statistics relevant to the OBE variables under study. Previous findings based on Muldoon's experiences (Alvarado & Zingrone, 1997) regarding a higher frequency of shocks to the body on rapid and sudden returns to the body, as compared to slow and gradual returns, were not replicated. Out of four cases with slow and gradual returns, 50% had shocks, as compared to 24% of the 38 cases of rapid and sudden return (N = 42, ?$^2$[1] =

.29, p = .30, 1t, phi = .08). Unfortunately, the low number of slow and gradual returns suggests this may not have been a proper test of the hypothesis.

| Variable | N | Percent |
|---|---|---|
| Distance from the physical body | 80 | |
| Less than 1-6 inches | 6 | 7.5 |
| 6 inches - 1 foot | 1 | 1.3 |
| 1-3 feet | 11 | 13.8 |
| 3-5 feet | 15 | 18.8 |
| 5-15 feet | 23 | 28.8 |
| 15-25 feet | 9 | 11.3 |
| 25 feet - several miles | 7 | 8.8 |
| Miles - other countries, or far away | 5 | 6.3 |
| Distance varied | 3 | 3.8 |
| Thinking and mental clarity compared with how you felt before the experience | 82 | |
| Worse | 6 | 7.3 |
| Same | 50 | 61.0 |
| Improved | 26 | 31.7 |
| Control of OBE movements | 68 | |
| Not at all | 38 | 55.9 |
| Sometimes | 5 | 7.4 |
| Most of the time | 11 | 16.2 |
| Always | 14 | 20.6 |
| Variable | N | Percent |
| Rate of return to the body | 69 | |
| Slowly, gradually | 4 | 5.8 |
| Somewhat slowly | 14 | 20.3 |
| Somewhat rapidly | 10 | 14.5 |
| Rapidly, suddenly | 41 | 59.4 |
| Shock felt on return | 77 | |
| No | 60 | 77.9 |

| | | |
|---|---|---|
| Yes | 17 | 22.1 |

**Table 1:** Frequency of OBE Variables Used in the Analyses

Another of the hypotheses based on Muldoon's experiences was a positive correlation between rate of control of movements during the OBE and distance from the physical body. This was confirmed ($r_s[65] = .36$, $p = .002$, 1t). Similarly, the prediction of a positive relation between clear thinking/mental clarity (one variable) and distance was also confirmed ($r_s[74] = .21$, $p = .04$, 1t). If the distances were limited to those less than five feet from the body (N = 29, Mean = .52, Mean Rank = 20.79) and those over 15 feet from the body (N = 18, Mean = 1.44, mean Rank = 29.17), which clearly include those below and above the eight feet range from the body emphasized by Muldoon for control, the difference was significant, z = 1.83, p = .03, 1t, r = .27. The results for thinking and mental clarity were not significant. They were as follows: Below 5 feet from body (N =17, Mean = 2.12, Mean Rank = 13.38), over 15 feet from the body (N = 11, Mean = 2.36, Mean Rank = 16.23), z = .89, p = .19, 1t, r = .17.

| Variables | N | Range* | Mean | Median | SD |
|---|---|---|---|---|---|
| Distance from the physical body | 77 | 1-8 | 4.66 | 5.00 | 1.91 |
| Thinking and mental clarity compared with how you felt before the experience | 82 | 1-3 | 2.24 | 2.00 | .58 |
| Control of OBE movements | 68 | 0-3 | 1.01 | 0 | 1.24 |
| Rate of return to the body | 69 | 1-4 | 3.28 | 4.00 | .98 |

**The ranges for each variables were as follows: Distance from the physical body (1 [less than 1 to 6 inches away] - 8 [other countries/far away]), thinking and mental clarity (1 [worse] - 3 [improved]), control of OBE movements (0 [not at all] - 3 [always]), rate of return (1 [slowly, gradually] - 4 [rapidly, suddenly]).*

**Table 2:** Ranges, Means, Medians, and Standard Deviations of OBE Variables

## DISCUSSION

The analyses related to Muldoon's experiences supported his views of the general characteristics of OBEs to some extent. There were significant positive correlations between measures of thinking and mental clarity during the experience, and control of movement as these two variables were related to distance from the physical body. This supports Muldoon's personal experiences in which he experienced better levels of mental clarity and control of movements farther from rather than closer to the body. The contrasts that took the extremes above the 8 feet range postulated by Muldoon to be critical (that is below 5 feet and 15 feet and above) were significant only for control of movements, however.

The prediction regarding shocks was not confirmed. Nonetheless we combined the significance levels of the present study (p = .30, 1t) with that of the previous study (Alvarado & Zingrone, 1997, p = .005, 1t). This yielded a Stouffer z of 2.21 (p = .01, 1t). Further work needs to be conducted on this point, because no conclusion can be drawn from only two studies.

A problem with these type of analyses is how to explain the findings. This research has not been guided by any particular theoretical model. However, we may speculate that when an individual is aware he or she is close to the body this may affect their mental state and their ability to coordinate their movements while having an OBE. Maybe closeness to the body reminds the experiencer of the state they are in and consequently leads to a reaction that interferes in some way with the utilization of the psychological resources assumed to be behind the manifestation of the OBE. This is only a vague speculation.

Although our study does not contribute to the testing of OBE theoretical models it is important to realize that the type of comparisons conducted here are important in that they allows us to explore the ideographic and nomothetic dimensions of OBE phenomenology. The OBE patterns of a single individual (Muldoon) may not generalize to other persons. After all, individuals like Muldoon seem to be rare. But the challenge of the research is to find out if there are aspects that can be generalized. Consequently, work such as this has the potential of dispelling myths, of testing the experiences of individuals who have been very influential in the astral projection lore for many years. This line of work allows researchers to be responsible to the social needs of people who are interested in these issues by producing research that is relevant to their concerns, and which speaks to the materials they read and believe. As such, we hope that future work will examine further the features experienced by Muldoon, as well as those experienced by other individuals who have written autobiographical accounts (e.g., Fox, 1939; Monroe, 1971; Harary, 1978; Turvey, 1911).

## REFERENCES

Alvarado, C.S. (1984). Phenomenological aspects of out-of-body experiences: A report of three studies. *Journal of the American Society for Psychical Research,* 78, 219-240.

Alvarado, C.S. (1997). Mapping the characteristics of out-of-body experiences. *Journal of the American Society for Psychical Research*, 91, 15-32.

Alvarado, C.S., & Zingrone, N.L. (1996a). The forgotten phenomena of parapsychology. *EHE News*, 3, 22-24.

Alvarado, C.S., & Zingrone, N.L. (1996b). La parapsicología y las tradiciones espiritistas y ocultistas: Ampliando el alcance del estudio de las experiencias humanas. In A. Parra (Ed.), *Segundo Encuentro Psi 1996* (pp. 23-27). Buenos Aires: Instituto Argentino de Psicología Paranormal.

Alvarado, C.S., & Zingrone, N.L. (1997a). Out-of-body experiences and sensations of “shocks” to the body. *Journal of the Society for Psychical Research*, 61, 304-313.

Blackmore, S.J. (1982). *Beyond the body: An investigation of out-of-the-body experiences*. London: Heinemann.

Crookall, R. (1961). *The study and practice of astral projection*. London: Aquarian Press.

Crookall, R. (1964). *More astral projections: Analyses of case histories*. London: Aquarian Press.

Fox, O. [1939]. *Astral projection: A record of out-of-the-body experiences*. London: Rider.

Gabbard, G.O.,Twemlow, S.W., & Jones, F.C. (1981). Do near-death experiences occur only near death? *Journal of Nervous and Mental Disease*, 169, 374-377.

Giovetti, P. (1983). *Viaggi senza corpo*. Milano: Armenia.

Green, C.E. (1968). *Out-of-the-body experiences*. London: Hamish Hamilton.

Harary, S.B. (1978). A personal perspective on out-of-body experiences. In D.S. Rogo (Ed.), *Mind beyond the body: The mystery of ESP projection* (pp. 260-269). Harmondsworth: Penguin Books.

Irwin, H.J. (1985). *Flight of mind: A psychological study of the out-of-body experience*. Metuchen, NJ: Scarecrow Press.

Mishlove, J. (1993). *The roots of consciousness* (2nd ed.). Tulsa: Council Oaks.

Monroe, R. (1971). *Journeys out of the body*. Garden City, NY: Doubleday.

Muldoon, S.J. (1936). *The case for astral projection*. Chicago: Ariel Press.

Muldoon, S.J., & Carrington, H. (1929). *The projection of the astral body*. London: Rider.

Muldoon, S.J., & Carrington, H. (1951). *The phenomena of astral projection*. London: Rider.

Osis, K. (1979). Insider's view of the OBE: A questionnaire study. In W.G. Roll (Ed.), *Research in parapsychology 1978* (pp. 50-52). Metuchen, NJ: Scarecrow Press .(Abstract)

Poynton, J.C. (1975). Results of an out-of-the-body survey. In J.C. Poynton (Ed.), *Parapsychology in South Africa* (pp. 109-123). Johannesburg: South African Society for Psychical Research.

Rosenthal, R. (1991). *Meta-analytic procedures for social research* (revised edition). Newbury Park, CA: Sage.

Twemlow, S.W., Gabbard, G.O., & Jones, F.C. (1982). The out-of-body experience: A phenomenological typology based on questionnaire responses. *American Journal of Psychiatry*, 139, 450-455.

Turvey, V.N. [1911]. *The beginnings of seership*. London: Stead's Publishing House.

Vieira, W. (1986). Projeciologia: Panorama das experiências da consciência fora do corpo humano. Rio de Janeiro: Author

# A DMILS STUDY WITH EXPERIMENTER TRAINEES[1]

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### ABSTRACT

A thirty-six session DMILS (direct mental interaction with living systems) study was conducted with agents attempting to activate and calm the electrodermal activity (EDA) of a receiver, at pseudo-random intervals. Both participants were housed in special electromagnetically and acoustically shielded rooms. Experimenters were drawn from an experimenter training course conducted at the Institut für Grenzgebiete der Psychologie und Psychohygiene. Each trainee conducted six DMILS sessions acting as the experimenter. To gain experience in all aspects of the DMILS environment, the trainees took turns acting as agent and receiver for the first half of the study. During the second half, experimenters worked with other friends and colleagues. Overall there was a non-significantly greater level of EDA during the activate periods than the calm (Stouffer Z= 0.94; effect size (r) = .16). In the 18 sessions conducted with the six trainee experimenters also acting as agent and/or receiver, the results showed slightly greater EDA during calming periods (Stouffer Z = -0.082; es (r) = -.02). In the 18 sessions where friends/colleagues participated, greater EDA was found during the activate periods, with the difference between activate and calm approaching significance (Stouffer Z = 1.417, p = 0.07, 1t; es (r) = .33). These findings are consistent with those from other DMILS studies, having effect sizes falling within the 95% confidence intervals derived from a recent DMILS EDA meta-analysis (Schlitz & Braud, 1997).

A significant release-of-effort effect (Stouffer Z = 1.826, p = 0.03,1t; es (r) = .43) was found for the non-trainee population, and in both populations the release-of-effort effects were larger than the primary effects. These findings suggest the possible utility of longer interaction periods and advise against the use of shorter rest periods.

Local sidereal time (LST) effects were explored for the first time in a DMILS study. Preliminary findings (with very small n's) support those obtained from anomalous cognition studies by Spottiswoode (1997), with an approximate 400% increase in mean session z within +/- 2 hour period of LST 13.5 (N = 3, mean z = 0.629; where the overall N = 36, mean overall session z = 0.157). Similarly, z's from sessions conducted within +/- 2 hours of LST 18.5 (N = 4, mean z = 0.076) were lower than the overall mean session z.

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## INTRODUCTION

Living systems have been used as targets in psi research for many years (see Morris, 1977 for a summary of early work) and this work is intimately linked with various notions of psychic healing (e.g., Solfvin, 1984). However, such research has recently grown in popularity due to the successful outcomes of a progressive research program carried-out by William Braud and his colleagues (for an overview, see Braud & Schlitz, 1991, and Schlitz and Braud, 1997). Braud further developed existing methodologies for working with living systems, and labelled the basic procedure as DMILS (direct mental interaction with living systems) studies (e.g., Braud, 1994). Currently, DMILS protocols are being increasingly used to address process-oriented questions (e.g., Watt et al., 1997; Delanoy and Sah, 1994).

Of special interest are the procedures involving an agent who by mental intentions attempts to selectively activate or calm a sensorially-isolated receiver, as measured by shifts in the receiver's electrodermal activity (EDA). These effects have been obtained both by Braud and associates (Braud & Schlitz, 1991; Braud et al., 1993a, 1993b) and by others (e.g., Radin et al., 1995; Schlitz & La Berge, 1994; Delanoy & Sah, 1994; Watt et al., 1997). Although its potential artifacts require consideration, nonetheless EDA is a non-intrusive, accessible measure and one of the more straightforward physiological indicators of arousal (see, e.g., Dawson et al., 1990, for a recent methodological review).

The current study is in part an attempt to obtain evidence of an agent-mediated effect upon a receiver's EDA in a new laboratory, with multiple experimenters and with unusually stringent sensory shielding between the agent and receiver. Effects obtained in parapsychology have usefulness in process-oriented research primarily to the extent that they can be conceptually replicated and extended in other laboratories, with different experimenters and experimental facilities. The authors are currently involved in the development of a new multi-purpose interpersonal psi testing facility at the Institut für Grenzgebiete der Psychologie und Psychohygiene (IGPP) in Freiburg, Germany, including the training of new researchers (via an experimenter training course and hands-on experimental participation). The first study conducted in the new facility, reported herein, utilised an EDA DMILS procedure. The study involved interested IGPP staff as both experimenters and research participants, to provide them with further training as parapsychological researchers. The experimental setting, described below, incorporates the use of state of the art shielded rooms for both agent and receiver, as well as computer-controlled psychophysiological monitoring and management of experimental conditions. The primary goals of this study were threefold: 1stly, to attempt replication of the basic EDA DMILS effect with new experimenters in a new facility; 2ndly, to provide an opportunity to evaluate the new facility for its appropriateness for DMILS and related research; and, 3rdly, to train potential new parapsychological researchers by providing first-hand experience with a challenging research protocol while gaining familiarity with various roles, as experimenter, agent and receiver, and also to provide experimenter experience working with a more usual participant population.

In achieving the first goal, various effects noted in other EDA DMILS studies would be sought. For example, Radin, Taylor and Braud (1993) found a significant release-of-effort effect in the first DMILS study conducted at the Edinburgh University parapsychology unit, where the activate or calming intentions appeared to be carried over into the following rest periods. As similar effects had been informally noted by the authors in other Edinburgh DMILS studies, it was of interest to see whether these effects would be present in the Freiburg data. Also, as the standard Braud DMILS study has the experimenter also acting as the agent, it was of interest to explore the outcomes of the trainees' own data (who would be contributing sessions both as experimenter and as agent/receiver), to look for similarities and/or differences between the two data sets. Different agent and receiver populations would be used in this study, with one population comprised solely of the trainees and the other involving external participants. Therefore, the two populations would be explored for any scoring differences. The sessions contributed by each individual trainee would also be explored looking for differences in their overall outcomes, to follow up on the differences between experimenters found in the Wiseman and Schlitz (1996) EDA DMILS (remote staring detection) study. Finally, given the recent finding of a relationship between local sidereal time (LST) and anomalous cognition study outcomes (Spottiswoode, 1997), these data would be explored for any similar findings.

## METHODS

The study was designed as a straightforward replication of Braud and colleagues' standard EDA-based DMILS procedure, comparing activate and calming periods within sessions (see Braud & Schlitz, 1991). However, unlike Braud's traditional EDA studies, the experimenter did not also serve as the agent, except in one session. Instead an experimenter worked with two participants, an agent and a receiver, as in some previous Edinburgh DMILS studies (e.g., Delanoy & Sah, 1991). Trainee experimenters would first conduct sessions amongst themselves, trading roles as experimenter, agent and receiver. When they were confident acting as experimenters, they were to bring other IGPP colleagues and friends to be agents and receivers.

### Participants

Six interested IGPP staff members, who were participating in an "experimenter training course" (offered by the authors), each agreed to act as experimenters in six sessions. Furthermore, they agreed to serve as agents and receivers in approximately six other sessions conducted by the other experimenters. They were encouraged to serve three times each as an agent and a receiver. After conducting approximately three sessions as experimenters with their co-workers, they were to serve as experimenters in three further sessions involving other friends and colleagues as participants. None of the experimenters had previous experience working in a DMILS study; two had prior experience in psi studies, one with RNG-PK studies, and another with an ESP study. The first author participated as an observer/trainer in the initial "within experimenter" sessions (approximately 6 sessions), and participated as an agent or receiver in four sessions.

## Experimental Facility

All sessions were conducted in an experimental suite of three rooms in the new offices of the Institut für Grenzgebiete der Psychologie und Psychohygiene, located on the first and second floors of an office building in downtown Freiburg. Each end room of the three room suite contain a customised acoustically and electromagnetically shielded cabin, purchased from the German branch of the international Industrial Acoustics Company (IAC; Industrial Acoustics Company, Gmbh, Sohlweg 17, 41372 Niederkrüchten, Germany). See Appendix 1 for a floor plan of the laboratory facility.

The receiver's cabin is double-walled with a well-padded reclining chair, dimmer lights adjusted to the receiver's preference (a relatively bright level was suggested to help the receiver maintain alertness), and a computer monitor display showing a pleasant abstract screen saver with randomly changing patterns. The agent's cabin is triple-walled with a reclining chair identical to the responder's, dimmer ceiling lights lit to the agent's preferred degree of brightness, and a computer monitor displaying a graphical representative of the receiver's EDA and agent activity instructions. The central room contains the experimenter's console and computer equipment, as well as a comfortable meeting area with an upholstered sofa and arm chairs. Acoustical attenuation tests have been conducted between the rooms as well as from inside to outside of each room. Between cabins (from the interior of the agent's cabin to that of the receiver) the acoustic shielding ranged from approximately 65dB at 60 Hz to between 90 - 100dB from 100 - 6000Hz. Also, the rooms have a degree of electro-magnetic shielding (contact the first author for further shielding specifications).

## Psychophysiological Monitoring System

The data were collected using a I-410 General Purpose System (produced by J & J Engineering, Inc.), supplied, with computer and applications, by Physiodata, Inc. (Bainbridge Island, WA, USA). Paul Stevens (of the Koestler parapsychology unit, Edinburgh University) created a program to monitor and process the experimental data acquisition and control the presentation of pseudo-randomised instructions to the agent. The data from each session was automatically saved onto the computer's hard disk, onto a Zip file, and hard copy was automatically printed of each session. Psychophysiological monitoring was accomplished by electrodes (10 mm, silver/silver chloride electrodes) attached to the distal phalanges of non-dominant hand, as recommended by Boucsein (1992), by means of velcro bands. Electrode paste (i.e., Sigma Creme; Parker Laboratories, Inc. and Femilind Gel, Johnson and Johnson) was used to improve conductivity. EDA was sampled 18 times per second, and activity summed to create an overall activity level for each 26.6 second interaction period.

The receivers' EDA was recorded for 17.7 minutes during each session. During this period there were 40 agent/receiver interactions periods, comprised of 10 activate and 10 calm sending periods, interspersed by 20 rest periods, where each period was of 26.6 seconds duration (e.g., rest - activate - rest - calm - rest - calm -...). Paired activate and calm periods were presented to the agent in a pseudo-randomised order within each session and from session to session. The randomisation was controlled by an algorithm within the computer program; no experimental participants (including the experimenter) were aware of the ordering before the session. The agent became aware of the randomised order only as the intentional instructions were presented to them during the session; the experimenter and receiver remained blind to the ordering throughout the data acquisition period.

A monitor display conveyed to the agent a graphical representation of the on-going EDA of the receiver, providing the agent with nearly simultaneous feedback of the receiver's EDA. The EDA display would restart from the left of the screen, at the start of every 26.6 second period. A written message at the bottom of the monitor display would inform the agent of the intention goal of each period (i.e., calm, activate, or rest).

## Procedure

For training purposes, all sessions were handled as if the participants were coming to the lab to take part in a session for the first time, even when the agent and receiver were experimenter trainees. Experimenters would greet participants at the IGPP entry door, and then escort them to the lab suite. They would be offered refreshment (i.e., juice, coffee, tea, biscuits, etc.) and would be seated in the "sitting room" area of the central room of the lab suite. Session description and instructions were interspersed with general conversation about various topics, to enable the experimenter to establish a friendly and trusting rapport with the participants and to help them become relaxed in the experimental environment.

Descriptions of the session and study aims were tailored to meet the specific interests of the participants when possible (i.e., the medical implications could be stressed to someone involved with heath care or interested in healing; interconnectedness issues discussed with someone interested in spiritual matters; teachers and/or counsellors could be told about the findings showing interpersonal helping/assisting effects in dyadic situations). The task was presented as a joint effort, involving equal contributions from the agent and receiver. The participants were asked to decide who wished to act as the agent and who as the receiver. If the participants were not sure about this, it was suggested that someone who was a good communicator (good at getting their ideas and wishes across to others) might most enjoy the agent's role, whereas the receiver role could put greater emphasis upon being attentive and responsive to the communications of others, and of being open and receptive. It was also suggested that the receiver might wish to share with the agent some suggestions that might help the agent convey the activate and calm instructions, i.e., receivers could tell the agent about situations that they found emotionally exciting and exhilarating, and also about ones they thought would calm them.

Receivers were instructed to be passively open and receptive to the states being conveyed by the agent during the session. They were to make no attempt to become consciously aware of the agent's intentions at any given time during the session, but rather to trust that their body would unconsciously respond appropriately. Receivers were asked to remain alert and to let their mind wander during the session, without dwelling too long on any one topic.

The agent was encouraged to think of things other than the receiver or study during the rest periods and was given the following strategies to help them convey the appropriate state to the receivers during the interaction periods (calm & activate):

1. Achieve the desired state in their own body with the goal of conveying this to or sharing it with the receiver.
2. Imagine the receiver in the appropriate state. This may involve imagining the receiver in a suitable activity, e.g., an exhilarating situation, such as scoring a goal, for the activated condition; and a very quiet, relaxed state, such as sleeping for the calm condition.
3. Interact with the feedback EDA display - "will" it to move a lot in the activate condition and to remain flat and still during calm periods.

Agents were encouraged to use the display of the receiver's on-going EDA as feedback regarding the success of their sending strategies. The three suggested strategies were presented as guidelines to be used as seemed most appropriate and effective, e.g., the strategies could be used alone or in combination with each other. Also, agents were free to devise their own strategies.

To help enhance expectations of and desire for success in the session, the positive outcomes of many other similar studies were mentioned. Also, it was noted how the findings from this study would add Germany to the list of places where such research was being successfully carried out.

When the participants fully understood the session procedures, they were given a tour of the rooms (including, for training purposes, the sessions where all participants were trainees). First all three visited the shielded cabin in which the agent would be housed. The screen display was briefly described as were other technical aspects concerning the use of the shielded cabins, such as the opening of the doors and the location of the button to contact the experimenter. It was mentioned that the shielded environments provided a beneficially quiet environment for the two participants, free from outside distractions, and also served to deal in advance with later questions about possible non-psychic, sensory ways in which the participants might have been able to communicate with each other.

After being shown the experimenter's area, the participants were taken to the receiver's shielded cabin. The receiver sat in the chair and the experimenter attached the electrodes (always referred to as "sensors") to the receiver, explaining that they should try to keep their hand relatively still during the interaction period. After checking that there were no further questions and that the participants were ready to start the session, the experimenter and agent wished the receiver well, and requested them to make a gentle wish that their body would respond unconsciously to the remote intentions of the agent. The door was then closed.

The agent and experimenter returned to the experimenter area to check that the electrodes were recording properly. Then the agent was escorted to the other shielded cabin. By this time a display showing the actual, on-going EDA of the receiver was on the monitor screen. After answering any final questions, the experimenter left the cabin and closed the door.

The experimenter then returned to the control area and hit a key to start the data collection. Thus the experimenter decided once exactly when to hit the key to start the session, initiate the randomisation of the calm and activate periods, and so on.

The end of the session was signalled to the experimenter via a computerised voice. The experimenter then collected the agent, and both proceeded to the receiver's cabin. The electrodes were removed and all returned to the experimenter's area. The experimenter prompted the computer to display a summary of the findings on a monitor. Thus all three participants received feedback as to the session outcome at the same time. The session data were automatically backed-up on to a Zip drive, in addition to hard disk storage. Another computer prompt produced five copies of the summary analyses of the session. The two participants were each given a print-out; one lodged with the investigator (DD), one kept by the experimenter, and a third put in the session log book.

The participants were then offered further refreshments, and the session discussed in as much detail as desired. The experimenter ensured the participants had a realistic perspective of their performance during the session before they left the lab, e.g., that the session results should not be taken necessarily as a valid indicator of their ability to perform any such DMILS functions in the course of their daily lives.

## HYPOTHESES AND PLANNED ANALYSES

1. The primary hypothesis was that significantly greater EDA would be elicited during the activate periods than during the calm periods, over all the sessions. The main, planned method of analysis would be a Wilcoxon matched-pairs sign test for each session's data, with the overall measure for the study being a Stouffer Z of the combined sessions' Wilcoxon z's. Effect size (r) would be reported, where effect size (es) = Stouffer Z / sqrt (n). Wilcoxon based analyses have been used in previous Edinburgh DMILS studies and elsewhere.

For comparison purposes, the analysis and effect size measure used by Braud and his colleagues would also be conducted (described in Braud and Schlitz, 1991). Thus a "percentage influence score" (PIS), would be calculated for each session, and a single sample t-test used to determine overall, across session outcome.

2. Using the primary (Wilcoxon/Stouffer Z) method of analysis, the data would be explored for various internal effects. One-tailed tests were used as directional effects (active EDA > calm

EDA) were expected, although given the small sample sizes it was not anticipated that outcomes would actually reach significance at the .05 level.

2 a. The results from individual trainee experimenters would be examined, both when acting as experimenter and when filling other participant roles.

2 b. The results from the different participant populations (i.e., trainee experimenters vs. others) would be explored for differences. (For comparison purpose, PIS-based outcomes will be reported also.)

2 c. PIS score analyses will be used to look for release-of-effort effects (Radin, Taylor, & Braud, 1993) in the rest periods following each interaction period.

3. The data would be examined for the local sidereal effects found by Spottiswoode (1997).

## RESULTS

1. The primary hypothesis was not supported, with the difference of EDA during activate and calm periods being in the right direction, but not to a significant degree (n = 36, Stouffer Z = 0.942, p = 0.174, one-tailed). The associated effect size was .16.

The PIS-based analysis showed a similar non-significantly greater degree of EDA in the activate periods (df = 35, t = 1.176, p = 0.124, one-tailed), with an effect size = .19.[2]

2. a. As anticipated, no individual obtained a significantly greater degree of EDA in activate periods across the six sessions for which they were the experimenter. Five of the experimenters obtained results in the expected directions (activate EDA > calm EDA), with one experimenter obtaining overall results slightly in the opposite direction. Two trainees obtained effect sizes larger than the mean EDA DMILS study effect size of .25 (i.e., .36, & .42). The remaining four effect sizes (.12, .10, .05 and - .11) all fall within the effect size confidence intervals derived by the authors from the recent Schlitz & Braud (1997) EDA DMILS meta-analysis (i.e., effect size confidence intervals: .39 to -.12). See Table 1 for trainee experimenter details.

Looking at the trainees' performances when acting as agent or receiver, four obtained results relatively consistent with those they obtained when acting as experimenter. One had a

[2] Three completed sessions were not included in the study analyses for technical and protocol reasons. In one session, the data was not saved onto any source due to an incorrect session entry (with no available data, no z could be calculated for this session). In the other two sessions, the experimenters did not adhere to the pre-arranged protocol: in one case, an extra session was run by an experimenter (z = -0.866); and in the other, the agent received no EDA feedback from the receiver (z = -0.663). All three sessions were run by different experimenters; two involved only trainee participants.

considerable improvement in overall effect size (experimenter es = .05, agent/receiver es = .70), whilst another obtained a similarly dramatic decrease in scoring, reversing the scoring direction obtained as an experimenter (experimenter es = .36, agent/receiver es = -.69).

The combined session Stouffer Z of one trainee, who obtained consistently high effect sizes both as experimenter (es = .42) and when acting as agent or receiver (es = .55), did reach marginal significance (N = 13, Z = 1.77, p = 0.04, one-tailed; es = .49).

| | Acting as Experimenter | | | Acting as Agt. or Rec. | | | All sessions combined | | |
|---|---|---|---|---|---|---|---|---|---|
| Pp | Session N | Stouffer Z | (r) es | Session N (agt/rec) | Stouffer Z | (r) es | Session N | Stouffer Z | (r) es |
| A | 6 | 0.250 | .10 | 4 (1/3) | 0.102 | .05 | 10 | 0.258 | .08 |
| B | 6 | 0.291 | .12 | 5 (1/4) | 0.225 | .10 | 11 | 0.366 | .11 |
| C | 6 | 0.125 | .05 | 5 (2/3) | 1.573 | .70 | 11 | 1.153 | .35 |
| D | 6 | 1.040 | .42 | 7 (5/2) | 1.445 | .55 | 13 | 1.767 | .49 |
| E | 6 | 0.874 | .36 | 5 (3/2) | -1.553 | -.69 | 11 | -0.402 | -.12 |
| F | 6 | -0.273 | -.11 | 10 (7/3) | -.0003 | -.0001 | 16 | -0.167 | -.04 |

**Table 1:** Results of six trainee participants (Pp) when: 1) acting as experimenter; 2) as agent or receiver; and, 3) when the two sets of outcomes are combined (all the sessions in which they participated).

2 b. The comparison between the two kinds of sessions (i.e., one consisting of just the trainees, the other involving at least one non-trainee as agent or receiver) showed superior results with non-trainees. When working only amongst themselves, the trainees scored in the opposite direction to that hypothesised, eliciting marginally greater EDA during calming than during activate periods (N = 18, Stouffer Z = -0.082, es = -.02). When working with at least one non-trainee participant (as agent or receiver), overall results approached significance (activate EDA > calm EDA), with N = 18, Stouffer Z = 1.417, p = 0.07; es = .33 (note: in 14 of the 18 sessions, both the agent and receiver were non-trainees).

For comparison with earlier PIS-based findings, the within trainee sessions obtained a marginally positive (activate > calm), nonsignificant outcome (df = 17, t = 0.392; es = .09), and the sessions involving non-trainee agents/receivers obtained a non-significant, positive outcome, with an effect size similar to the mean of previous studies (df = 17, t = 1.227; es = .28).

2 c. The analysis looking for release-of-effort effects focused on comparing the rest periods following the activate periods (a-rest), and the rest periods following the calm (c-rest). Overall, the a-rest period showed marginally greater EDA activity than the c-rest (Stouffer Z = 0.305; es = .05). This represents a lower level effect than the .16 effect size found in the comparison of the

actual activate / calm periods.

The data from the two agent/receiver populations showed similar scoring direction to those obtained in the primary activate/calm analyses, but the magnitude of effects increased, substantially so in the trainee's data. For the trainee population, non-significantly greater EDA was elicited during the c-rest than during the a-rest periods (Stouffer Z = -1.394; es = -.33). For the non-trainee population, there was a significant difference (activate > calm) between the a-rest and c-rest periods (Stouffer Z = 1.826, p = 0.03, one-tailed; es = .43). Thus, for the trainees, the magnitude of the negative activate/calm es changed from -.02 to -.33 during the rest periods; for the non-trainees, the positive activate/calm es of .33 increased to .43.

3. Focusing on the local sidereal times (LST) of 13.5 and 18.5, identified by Spottiswoode (1997) as relating most strongly to the anomalous cognition database, we had too few sessions for more than just a descriptive analysis. As expected based on the earlier results, there was a high mean session z produced at LST 13.5 +/- 2 hours (z = 0.629, N = 3) and a low mean session z at LST 18.5 +/- 2 hours (z = 0.076, N = 4). The overall mean session z = 0.157 (N = 36) .

## DISCUSSION

While the overall measure did not reach significance, the effect size of .19 from the PIS analysis is comparable to the mean study effect size .25 (primarily derived from PIS analyses) from other DMILS EDA studies. One question of interest to the authors is whether the PIS or Wilcoxon analyses are best applied to these studies. The PIS would be more sensitive to a large deviation at any time during a session than would the Wilcoxon, while the Wilcoxon could be more sensitive to small but consistent differences between the calm and activate periods. In a previous study (Delanoy & Sah, 1991) a significant overall outcome was obtained with the Wilcoxon (p = 0.04 1-t; es = .31), but not with the PIS (p = 0.08; es = .25). In the present study this trend was reversed, with slightly higher scoring obtained by the PIS method. Looking at the successful non-trainee agent/receiver sessions, the Wilcoxon measure produced a larger effect than the PIS measure. The data from the trainee agent/receiver sessions displayed only marginal departures from chance expectancy, with the PIS measure obtaining a slightly positive outcome and the Wilcoxon a slightly negative result. Thus, the question of which measure may be the more sensitive when applied to EDA DMILS is still open.

While the overall results were not significant, those examining the different agent and receiver populations were more encouraging. The trials involving the trainees as agents and receivers were intended as training sessions, to familiarise the trainees with all aspects of the methodology. Also, it was wished to provide them with the experience of learning how to act as an experimenter, therefore making them comfortable with the role, before they worked with the general public. Whilst it was disappointing that their scores when working with each other were slightly opposite to the hypothesised direction, these sessions were conducted primarily as preparation for their working with other participants. The preparatory nature may have had a variety of psychological effects on the participants; or perhaps we are seeing a learning effect, as the within trainee sessions generally preceded the sessions where others acted as agent or receiver (i.e., all of the first 16 sessions of the study involved only trainees as participants). Additionally (as discussed below), the equipment problems that plagued the earlier sessions may have had a negative impact upon session outcome.

The effect size (.33) from their sessions with non-trainee participants compares favourably with the mean DMILS EDA study effect size of .25 (Schlitz & Braud, 1997), and the result approached significance with an N of only 18. Thus, the trainee experimenters obtained the desired outcomes in the sessions which most resemble the usual DMILS environment. While undoubtedly there were psychological differences between the purely training sessions and those involving other members of the public, this study was not designed to explore such differences and further speculation about possible causes would be unwarranted. However, there were numerous equipment problems encountered in the earlier stages of the experiment, which were essentially sorted out before non-trainee participants were involved in the sessions.

As indicated, this study was most useful in helping to further refine the equipment and software controlling the data collection. Problems were encountered in the course of the study, and 10 sessions were abandoned due to equipment failure. In these 10 sessions, the system would most commonly crash before any data for the trial was collected, but after the pre-session talks had been given and the agent and receiver were located in their respective shielded rooms. These problems could have impacted negatively on the scoring rate, as it was very frustrating for the trainees to gather for a session, proceed through the initial pre-session chat, advance to the data collection stage, only to have the system crash at the critical moment. These problems were due to a programming error that was eventually identified and remedied. Also, minor modifications of the software program were made to simplify the set-up program entry procedure for the experimenters.

This is the first time that two acoustically and electro-magnetically attenuated rooms were used to house the agent and receiver in a DMILS study. The outcomes indicate that these unusually stringent security measures appear to provide no obstacle in obtaining standard DMILS effects. Furthermore, we were pleased to discover that participants did not find the use of such imposing structures intimidating or problematic in any noted respect.

The study of Wiseman & Schlitz (1996) indicates that some experimenters may be more likely to obtain significance results from their participants than others in DMILS studies, lending further support to similar "experimenter effect" findings from other areas of psi research. The investigation of individual trainees was conducted in part to see if any tendencies for especially good or especially poor outcomes were associated with any individual trainee. We looked at their performance both when acting as experimenter and when acting as agent or receiver, as these roles are difficult to separate in the traditional DMILS design (e.g., in the Wiseman and Schlitz study) as in these earlier studies the experimenter also acted as the agent. In the present study, one experimenter appeared to excel in both roles, obtaining an unexpected overall significance when combining all their sessions (p = .04, one-tailed; es = .49). Further examination of this individual's data revealed a general tendency, both as experimenter and agent/receiver, to obtain small, above chance deviations from MCE (of 12 sessions, only two were slightly in the wrong direction, and only two obtained z's in excess of 1.00). Five of the six trainees showed similar directional effects in both sets of sessions (experimenter and agent/receiver sessions), with one showing a much greater magnitude of effect in their sessions as agent/receiver. Only one trainee showed a reversal of effects between their sessions as an experimenter and those as agent and receiver (es for experimenter sessions = .36; es for agent/receiver sessions = -.69). Excepting the one instance of reversal of outcome direction, these findings suggest that more data needs to be collected where the role of the experimenter and agent are clearly differentiated before understanding whether the Wiseman & Schlitz findings are best interpreted as effects stemming from the experimenter, from the agent or from some interaction between the two.

While of potential interest, the role that gender may play in the agent/receiver pairing, or in acting as experimenter with different combinations of agent/receiver gender pairings, could not be addressed due to insufficient sample sizes. Of the six trainees, only two were female, and they each worked primarily with two different males in the trainee sessions. The agent/receiver gender pairing was generally mixed in the non-trainee agent/receiver sessions. Looking just at the data each trainee produced as experimenter, one male and one female produced effect sizes above the mean study effect size of .25 (es = .36 and .42, respectively). Considering all the sessions in which the trainees participated (as experimenter and as agent/receiver), the only independently significant overall results for an individual trainee were produced by a male; the two overall negative Stouffer Z's were produced by a male and a female. It is hoped to explore gender issues more thoroughly in future DMILS studies.

The release-of-effort findings suggests that the intentionality effects may have carried-over into the subsequent rest periods. Within both agent/receiver groups, the magnitude of the apparent DMILS effects were greater in the rest periods, than in the preceding "intentionality" period (trainee group effect size increased from .33 to .43; non-trainees changed from -.02 to -.33). Indeed, in the sessions which showed the greatest evidence of a positive DMILS interaction (i.e., the non-trainee agent/receiver sessions), the release-of-effort effect reached significance (p = 0.03). From this it appears that the lack of a release-of-effort effect in the overall session data was due to a cancellation effect from the scoring of the two agent/receiver populations.

These findings lend support to the significant release-of-effort effect reported by Radin, et al. (1993), although it should be noted that Radin's analysis was based on the first 10 seconds of their 30 second rest period, where as in the present study the whole of the rest period was used. The outcomes may suggest that DMILS EDA effects could be increased by lengthening the period of the traditional 30 second interaction periods. Also, it argues in favour of retaining at least a 30 second rest period between each interaction period to ensure there is no carry-over of effects from one intention period (i.e., activate) to another (i.e., calm). Indeed, there may still be a carry-over effect with 30 second rest periods. The apparent release-of-effort effect requires further confirmation and exploration in future studies.

The LST findings are very intriguing. This is the first time that DMILS data has been explored for LST effects, and the results show a similar pattern to those from the anomalous cognition database (Spottiswoode, 1997). However, the sample sizes in this study are obviously too small to allow any conclusions to be made. Further analyses of existing and new DMILS databases are planned for the near future.

In conclusion, this study fulfilled the primary goals for which it was intended. The effect sizes from the set of sessions most representative of the norm were above that of the mean for existing EDA DMILS studies. Additionally, some interesting internal effects were found, consistent with those from existing studies. Actual and potential equipment short-comings were identified and corrected. And several of the IGPP staff who took part in the study as trainees will be working as experimenters in future DMILS studies. We are encouraged by these outcomes, and anticipate fruitful findings in the future DMILS studies which are planned for this facility.

## REFERENCES


Boucsein, W. (1992). *Electrodermal Activity.* New York: Plenum Press.

Braud, W.G. (1994). Can our intentions interact directly with the physical world? *European Journal of Parapsychology,* 10, 78-90.

Braud, W.G. and Schlitz, M.J. (1991). Consciousness interactions with remote biological systems: Anomalous intentionality effects. *Subtle Energies,* 2:1, 1-46.

Braud, W., Shafer, D. and Andrews, S. (1993a). Reactions to an unseen gaze (remote attention): A review, with new data on autonomic staring detection. *Journal of Parapsychology,* 57, 373-390.

Braud, W., Shafer, D. and Andrews, S. (1993b). Further studies of autonomic detection of remote staring: Replication, new control procedures, and personality correlates. *Journal of Parapsychology,* 57, 391-409.

Dawson, M., Schell, A. and Filion, D. (1990). The electrodermal system. In J.T. Cacioppo and L.G. Tassinary (Eds.) *Principles of Psychophysiology*. Cambridge: Cambridge University Press, 293-324.

Delanoy, D.L. and Sah, S. (1994). Cognitive and physiological psi responses to remote positive and neutral emotional states. *Proceedings of the 37th Annual Convention of the Parapsychological Association*, Amsterdam, The Netherlands, August, 1994, 128-139.

Morris, R. L. (1977). Parapsychology, biology, and anpsi. In B.Wolman (Ed.) *Handbook of Parapsychology*. New York: Van Nostrand Reinhold Co., 687-715.

Radin, D.I., Taylor, R.K. and Braud, W.G. (1993). Remote mental influence of human electrodermal activity: An experimental replication. In M.J. Schlitz (Ed.) *Proceedings of Presented Papers of the Parapsychological Association 36th Annual Convention*. August, 1993, Toronto, Canada, 12-23.

Schlitz, M. and Braud, W. (1997). Distant intentionality and healing: Assessing the evidence. *Alternative Therapies*, 3:6, 62-73.

Schlitz, M.J. and LaBerge, S. (1994). Autonomic detection of remote observation: Two conceptual replications. *Proceedings of the 37th Annual Convention of the Parapsychological Association*, Amsterdam, The Netherlands, August, 1994, 352-360.

Solfvin, J. (1984). Mental healing. In S. Krippner (Ed.) *Advances in Parapsychological Research, Volume 4*. Jefferson, NC: McFarland and Co., 31-63.

Spottiswoode, S.J.P. (1997). Apparent association between effect size in free response anomalous cognition experiments and local sidereal time. *Journal of Scientific Exploration*, 11:2, 109-122.

Watt, C., McDermott, Z. and Ravenscroft, J. (1997). Exploring the limits of remote mental interactions: A comparison of blocking versus cooperating strategies. In R. Wiseman (Ed.) *The Proceedings of Presented Papers of the Parapsychological Association 40th Annual Convention held in conjunction with the Society for Psychical Research*. Brighton, England, August 1997, 464-476.

Wiseman, R and Schlitz, M. (1996). Experimenter effects and remote detection of staring. In E.C. May (Ed.) *Proceedings of Presented Papers of the Parapsychological Association 39th Annual Convention*, San Diego, CA, August 1996, 149-157.

# ATMOSPHERIC ELECTROMAGNETISM: THE POSSIBLE DISTURBING INFLUENCE OF NATURAL SFERICS ON ESP[1]

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**ABSTRACT:**

Very Low Frequency (VLF) sferics are electromagnetic impulses with frequencies between 1 kHz and 100 kHz, which are generated by lightning discharges. The signals, which are of extremely low intensities and short durations, propagate with approximately the speed of light through the atmosphere over distances of thousands of kilometers. Besides their significance as indicators of thunderstorm activity, biological affects of sferics have been reported. Positive correlations were observed between natural sferics rates and the occurrence of pathological incidences, such as pain syndromes, myocardial infarctions and epileptic seizures. Further, elevated sferics activity was found to be associated with reduced performance levels in reaction time and concentration tasks. Within simulation studies, sferics exposure was able to provoke changes in the electrocortical activity of subjects by enhancing the power within the alpha band of the EEG.

In the present study, in which 100 subjects took part, the relation between the performance on a forced choice extrasensory perception (ESP) task and various indices of natural sferics activity (mean sferics rate during the ESP session, changes in sferics rates during the last day, and week) was studied. In addition, different secondary variables (psi-belief, religiosity, neuroticism, extraversion, openness, agreeableness, conscientiousness) were assessed in order to investigate their possibly modulating effect on the association of the two parameters.

The main finding of the study was a negative correlation between ESP performance and sferics activity, which was most notably with regard to the sferics rates obtained in the 24-48 hours prior to the session. Personality variables modulated this correlation. In agreement with prior research on biological effects of sferics, the correlation tended to be stronger for individuals who had scored lower on neuroticism and higher on the openness scale of a five-factor personality questionnaire.

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## INTRODUCTION

In the 1980's, a number of studies were carried out to study the relationship between variations in the geomagnetic field and extrasensory perception (ESP), either spontaneous (Persinger, 1987a) or experimental (Makarec & Persinger, 1987; Persinger & Krippner, 1989; Spottiswoode, 1990). The paradigm constituted a role for electromagnetism, but not as the medium of information transmission, although Persinger mentioned extremely low frequency (ELF) electromagnetic waves as such in his earlier publications (Persinger, 1974). That approach had been dismissed since long, but has the tendency to resurface now and then. However, the apparent occurrence of ESP over intercontinental distances, and perhaps more definitively, the existence of apparent causality-violating phenomena, namely precognition and retroactive PK (see e.g. Schmidt, 1976), cannot be explained by any kind of transmission via electromagnetic waves or fields. Rather, regardless of the exact processes involved, ESP might be disturbed by electromagnetic influences, either through its purported transmission, or through hindering the transmitted information reaching a detectable level (Persinger, 1989).

Although as a comparison the studies of the earth's magnetic field are interesting, the subject of the present paper is another electromagnetic phenomenon in the natural environment, namely sferics. These are electromagnetic disturbances, caused by thunderstorms (lightning), which are easily detectable at distances of up to several thousand km.

To make a brief comparison between different electromagnetic phenomena, on the earth's surface - without special shielding - one is subject to the constant geomagnetic field, strongest at the poles and weaker at the equator, with an average field strength at middle latitudes of about 50000 nT. Superimposed on this are variations, mainly due to the solar wind, with amplitudes of up to about 1000 nT, with typical time scales of minutes to hours, or, frequencies of the order of 0.01 Hz down to 0.0001 Hz. The effects of these variations have been studied by Persinger (1987b) and others.

Sferics are a very different electromagnetic disturbance with regard to timescale and amplitude as compared to geomagnetic activity. According to their dominant frequency components sferics are classified into Very Low Frequency (VLF) and Extremely Low Frequency (ELF) sferics, with frequencies of 1 to 100 kHz (VLF) and 1 to 300 Hz (ELF), respectively. VLF-sferics - this is the type we consider in this study - are generated by lightning discharges and are travelling with about the speed of light through the atmospheric waveguide, bounded on the one side by the earth's surface and on the other side by the lower ionosphere. The duration of a typical VLF-sferic is about 0.5 ms and its amplitude at short distances (ca. 50 km) may be up to about 60 nT, falling off at 1000 km to about 3 nT, as described by Betz and his co-workers (1996). VLF-sferics constitute a brief, damped electromagnetic oscillation with a frequency spectrum peaking at about 10 kHz at larger distances. In contrast, ELF-sferics have longer durations and smaller amplitudes.

Sferics have attracted attention as a possible cause of weather sensitivity, characterized typically by discomfort or somatic complaints occurring one or a few days before a change of weather. Reiter (1960) studied a wide range of biological effects of sferics. For instance, he observed that his patients displayed pain symptoms one or two days before an upcoming weather change, when there were no visible signs of this change, but when sferics activity had already increased. Numerous other correlational studies have been carried out, observing positive relationships between rates of occurrence of sferics and biological indicators, such as the occurrence of pain symptoms in different patient groups (Ludwig, 1973; Pelz & Swantes, 1986), the number of clinical admissions due to myocardial infarction (Ruhenstroth-Bauer *et al.*, 1985) and errors made in a concentration task (Laaber, 1987). An overview of these studies is given by Schienle *et al.* (1996).

Taking these relationships as indications for a possible influence of sferics on the central nervous system, Schienle and her co-workers conducted experiments establishing the effects of simulated sferics on the electroencephalogram (EEG) (Schienle *et al.*, 1996, 1997). They found, in their first study, sferics application to result in less power in the alpha band of the EEG. An important aspect of their findings is the differential effect between groups of subjects characterized by high versus low somatic complaints and high versus low neuroticism. In the first of their studies, the effects on the EEG were significantly higher in the low-complaints and the low-neurotic groups, the effect of sferics appearing to be absent in the high-complaints and high-neurotic groups. This is tentatively interpreted in their 1996 article as a lack of adaptability to atmospheric conditions in the subjects scoring high on the somatic complaints or neuroticism scales.

In their second study (Schienle *et al.*, 1997) the duration of the effect on the EEG of 10 minutes exposure to artificially generated sferics was assessed. Enhanced power levels in the alpha and beta bands of the EEG lasted longer, at least 20 min after the end of exposure, for subjects scoring high on somatic complaints, neuroticism, or, weather sensitivity. In contrast, the subjects who were not weather-sensitive, who had few somatic complaints and who were emotionally stable, revealed a quicker return to baselinelevel during the 10 minutes after sferics exposure.

It may be concluded that in both these experimental studies an effect of sferics was demonstrated, and in both interacting with neuroticism and somatic complaints.

These findings provoke the question about the occurrence of ESP: Do sferics affect ESP as well they do the EEG? On the one hand, such an influence would be analogous to the extant model of the geomagnetic effect on ESP, and on the other hand, it would fit well with the established biological influence of sferics. It may well be of significance that traits like neuroticism and somatic complaints interact with the sferics influence: The relationship between personality variables and ESP also is well-established: Palmer (1977) gives an overview and overall analysis of the relevant findings. A study of ESP and personality variables, employing a very similar ESP-test as the present study, has been described by Haraldsson and Houtkooper (1992). They found significant negative correlations between ESP performance and perceptual defensiveness, as well as with psychotism, and a significant positive correlation with a religiosity scale.
An experiment with forced-choice ESP, carried out at the University of Giessen, has been

employed to explore the relationship between sferics and ESP scoring.

## METHOD

### The subjects

One hundred subjects were tested during February-July 1996. 57 Subjects were female, 43 were male. Ages ranged from 14 to 75, with a median age of 31, mean 33, and a standard deviation of 10 years. Subjects were recruited by a newspaper advertisement which was put up about once a month, in which 'serious participants over 18' were requested for an ESP experiment, part of a research project at the Psychology Department of the Justus-Liebig-University of Giessen. Payment offered was 15 Deutsch Mark for a session of about 1 hour. This advertisement resulted in about 15-20 reactions each time. Of these 100 participants it might be said, that, a few were just curious about psychological experiments, very few just interested in the payment, but the majority had a genuine interest in ESP. Questionnaire data allow a more detailed description, but these details fall outside the scope of this paper.

### The ESP task

The ESP task administered to the subjects, was similar to the computerized ESP task in the ten Icelandic DMT-ESP experiments, as described by Haraldsson and Houtkooper (1992). In this task, two subjects participated, alternately doing 10 trials, for a total of 40 trials each. The computer program had been developed from the earlier version by Prof. Dr. E. Haraldsson, to make use of better graphics capabilities of PC and Macintosh computers.

In the ESP task each trial consists of making a guess between a row of four rectangles on the display screen, by pointing at them with the mouse. After confirming the choice by clicking a mouse-button, the rectangle chosen either revealed the word 'blank', or a picture, each time randomly chosen from a fixed set of 16, ranging from pictures of persons, landscapes, to abstract art. After this feedback, the subject had the option to 'open' one or more of the other rectangles to confirm his or her second choice, to see where the target picture was, and to see what it was. The computer program recorded of each trial the rectangle being the target, the first choice of the subject and for the session the number of hits each of the two participants has obtained, as a control. Moreover, the computer program tested the random generator, consisting of a Zener-diode-noise based physical random number generator, combined with a pseudo-random algorithm, before and after each session.

In the present study, the first author (JMH) acted as the co-subject in each session. This was regarded as beneficial to one purpose of the experiment, the creation of a pool of subjects, familiar with the laboratory and one of researchers involved. To the author's experience, the ESP task proved to remain interesting throughout the experiment.

## Sferics

Throughout the course of the year, VLF-sferics were monitored continuously in Giessen. The raw signals were cleaned of artifacts and counted per hour. These counts, as registered in Giessen in 1996, number in the range of 0 to 5735 per hour, with a median value of 151. The mean count per hour was 301.3, with a standard deviation of 467.0. That is, the sferics counts reveal a very skewed distribution. Therefore, the data were transformed by the logarithmic transformation y = log(x + 1), as recommended by Gaddum (1945). This transform, which can be considered as linearizing such relationships as characterized by the Weber-Fechner law of biological responses to physical stimuli, resulted in close to normal distributions, whereas the original distributions were highly skewed. The logarithmic transformed counts, or log-counts, fell within the range of 0 to 8.655, revealed a median of 5.024, a mean of 4.992 and a standard deviation of 1.248.

The sferics data varied with a diurnal as well as an annual rhythm, best described by a maximum around midnight for most of the year. In the summer months there is additional intense activity around mid-afternoon, being then the daily maximum activity. The average log-counts, of our registration in Giessen during 1996, are given in Table 1 (hours of minimum and maximum activity are numbered from 0 to 23, 0 meaning 0:00-1:00 UT, etc.). Although years may differ, and activity may differ much between different locations and climates, these figures demonstrate how the sferics activity varied in time during the course of our experiment, which took place from February to July 1996.

| | Log-count per hour | | | Max. activity | | Min. activity | |
|---|---|---|---|---|---|---|---|
| Period | Mean | S.D. | Median | Mean | (hour) | Mean | (hour) |
| January-April | 4.34 | 1.07 | 4.39 | 4.76 | 0 | 3.93 | 9 |
| May-August | 5.62 | 1.26 | 5.72 | 6.42 | 14 | 4.74 | 6 |
| September-December | 5.00 | 1.06 | 5.08 | 5.43 | 0 | 4.58 | 15 |

**TABLE 1**: Annual and diurnal change in hourly log-counts of sferics.

## Sferics variables

Sferics activity has been characterized by different variables. In our exploratory study, we chose a range of variables that represent actual and time displaced activity, and changes in activity. Primarily, we chose the following variables:

ACTUAL: Actual log-count sferics, during the hour in which the ESP session started.
AV24H: The log-count sferics, averaged over the preceding 24 hrs.
SD24H: The standard deviation between the 24 preceding hourly log-counts.

DIF24H: The difference between the averaged log-counts of sferics in the preceding 24 hrs and the log-counts averaged over the preceding week.

SDWEEK: The standard deviation between the daily averages of log-counts of the preceding week.

These measures are appreciably correlated, as will be shown in the Results section.

In the following, we will use 'sferics activity' to indicate the logarithmic-transformed counts of sferics, averaged over an indicated period of time.

The recorded sferics counts are about 99% complete, but some data loss occurred due to power failures and the like. Missing data were identified and the averages or standard deviations, used in the above variables, were calculated using the non-missing data points available.

## Questionnaires

The following questionnaires were administered in the experiment:

Participant Information Form (PIF): This biographic questionnaire was derived from items translated into German from similar questionnaires, in use in ganzfeld research at the Koestler Chair of Parapsychology in Edinburgh, Scotland (see Morris *et al.*, 1995), and at the Rhine Research Center in Durham, North Carolina (see Broughton & Alexander, 1995).

Psi-Belief: Besides a 7-point scale item in the PIF, the translated 3-item Icelandic Sheep-Goat Scale (Haraldsson & Houtkooper, 1992), and the German Questionnaire on Attitudes towards Extraordinary Themes (FEAT, see Mischo *et al.*, 1993) were included.

Personality measures: A German version of the NEO-PI (Costa & McCrae, 1992), the 60-item NEO-FFI (Borkenau & Ostendorf, 1993) was administered, to obtain measures of neuroticism, extraversion, openness, agreeableness and conscientiousness.

Religiosity: A 9-item religiosity scale (Haraldsson, 1993) was administered.

## Data analysis

In this exploratory study we examined if one or more measures of sferics activity would have an influence on ESP scores. To that effect, we calculated Pearson product moment correlation coefficients. Of primary interest were the five sferics variables as defined above and the ESP scores. Moreover, we calculated the correlation coefficients for extreme groups on the personality variables. This was realized by calculating the 33rd and 67th percentiles and taking cutting points closest to these, but between two actual values of the relevant variables.

## RESULTS

The five sferics variables were examined for interdependencies. The intercorrelations are given in Table 2. The variables AV24H and ACTUAL are correlated strongest with r = .77.

| | | ACTUAL: | AV24H: | SD24H: | DIF24H: | SDWEEK: |
|---|---|---|---|---|---|---|
| ACTUAL: | Actual hr of session: | 1 | | | | |
| AV24H: | Preceding 24 h average: | .774 | 1 | | | |
| SD24H: | Std.dev. of 24 h: | .052 | -.080 | 1 | | |
| DIF24H: | Diff. 24 h - 1 week: | .429 | .644 | -.386 | 1 | |
| SDWEEK: | Std.dev. of 1 week: | .323 | .256 | .248 | -.052 | 1 |

**TABLE 2:** Intercorrelations between sferics variables in the sample (100 sessions)

The results of the randomness tests wich were carried out on 1000 trials collected before and 1000 trials after each 80-trial session (40 trials by the subject and 40 by the co-subject) showed the randomly generated targets to be unbiased, that is, there was no significant deviation from chance expectancy.

The ESP scores revealed no overall extrachance scoring: the subjects obtained an average of 9.91 hits (SD = 2.82), where 10 were expected by chance (z = -.329, n.s.), while co-subject scores averaged at 10.10 hits (SD = 2.99; z = .365, n.s.). The correlations of the ESP-scores with psi-belief (r = -.16), extraversion (r = -.03) and religiosity (r = -.01) were nonsignificant. The correlation with neuroticism turned out to be r = .17 (p = .092, two-tailed).

| | Sferics log-count during: | ESP-score: Subject | Co-subject | Combined |
|---|---|---|---|---|
| ACTUAL: | Actual hr of session: | -0.104 | -0.067 | -0.119 |
| AV24H: | Preceding 24 h average: | -0.207* | -0.124 | -0.229* |
| SD24H: | Std.dev. of 24 h: | -0.081 | 0.072 | -0.004 |
| DIF24H: | Diff. 24 h - 1 week: | -0.200* | -0.068 | -0.185+ |
| SDWEEK: | Std.dev. of 1 week: | 0.049 | 0.117 | 0.117 |

+: p < .10, *: p < .05, two-tailed

**TABLE 3:** Pearson correlations between sferics variables and ESP-scores of subject and co-subject, and the combined ESP-score per session (N=100).

Correlations of the five primary sferics variables with ESP-scores are shown in Table 3, where correlations are given for subject and co-subject scores separately and for the combined ESP-score of subject and co-subject per session.

Two of the sferics variables show significant correlations with ESP performance by the subject. These are AV24H, the average log-count of sferics in the 24 hours that precede the hour in which the session starts, and DIF24H, the difference between this same average and the average log-count of sferics during the week before the day of the session. Respective correlations are $r = -.21$ ($t(98) = 2.092$, $p = .039$, two-tailed) and $r = -.20$ ($t(98) = 2.022$, $p = .046$, two-tailed). For AV24H the correlation is slightly higher if the ESP scores by subject and co-subject are combined. The correlation between AV24H and the combined ESP-score was $r = -.23$ ($t(98) = 2.334$, $p = .022$, two-tailed). These correlation all have the sign in the direction of lower sferics activity being associated with higher ESP scores.

To explore the relation between ESP performance and sferics activity as it varies over time we first took the daily averages of the seven days before, the day of the session, and the six days following the session. The correlations between the combined ESP score per session and the daily averages of sferics activity are represented in Figure 1.

In Figure 1 a relatively sharp dip appears. Relatively sharp, because sferics show a considerable consistency over time, part of which is due to seasonal variation. We calculated for our sample, the correlations of sferics activity at the day of the session with that of 1, 2, up to 7 days before. The correlation with the day before was .77, with 2 and 3 days before, .55 and .48 respectively, and with 7 days before still .29. Nevertheless, in Figure 1 the sferics-ESP correlation appears to be concentrated on the day before the session.

In order to obtain more detail with regard to the time-course of the sferics activity, we calculated average sferics activity for periods, including the hour of the session, stretching backwards up to 72 hours before the session. The resulting correlation coefficients reveal a gentle maximum: For the combined ESP scores the (absolute) correlation reached its maximum for a time-span of 34 hours, where $r = -.254$, as compared with $r = -.225$ for a time-span of 24 hours, $r = -.223$ for 48 hours and for the longest time-span explored, 73 hours, the correlation had dropped to $r = -.191$.

To determine whether or not the sferics-ESP correlation depends on personality variables a comparison was made of extreme groups of subjects on each personality dimension. The extreme groups were taken as each consisting of about a third of the 100 subjects. Thereby, on each dimension the middle third was excluded. For each of the five personality dimensions as rendered by the NEO-FFI, the 'high' and 'low' groups are represented in Table 4.

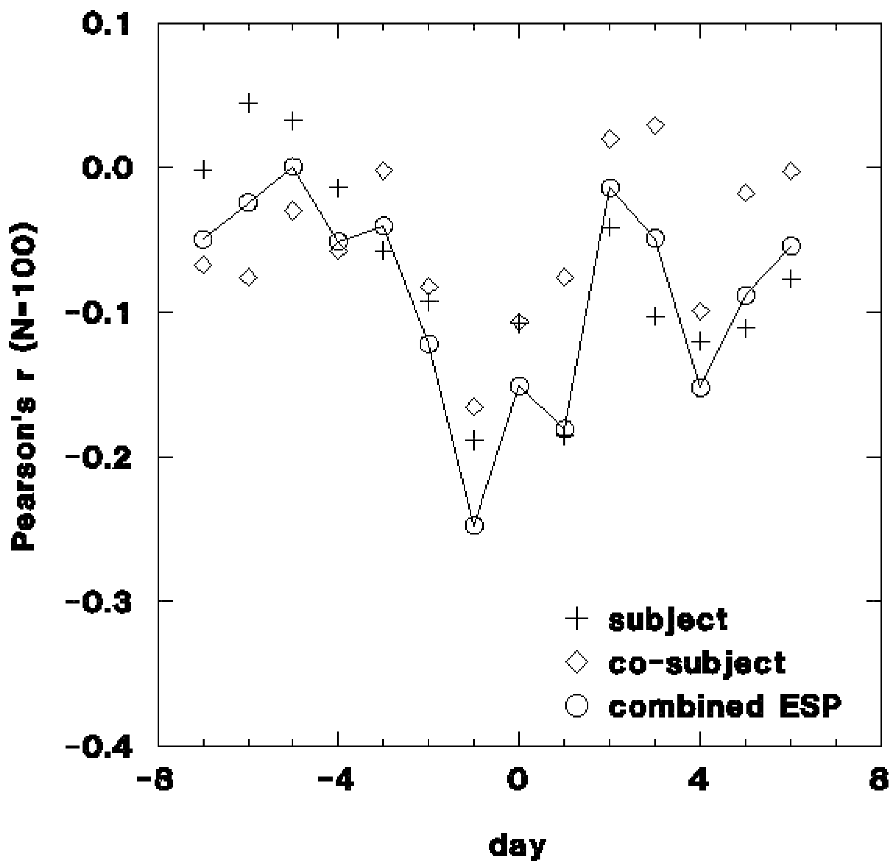


**Figure 1:** Correlation between ESP score and sferics activity on days before and after the session.

| Personality between dimension: | Low group (L) | | High group (H) | | Difference effect sizes | |
|---|---|---|---|---|---|---|
| | r | N | r | N | $ES_{H-L}$ | $z_{H-L}$ |
| Neuroticism | -.438** | 35 | -.027 | 35 | .424 | 1.772+ |
| Extraversion | -.079 | 36 | -.130 | 33 | | |
| Openness | -.078 | 33 | -.509** | 31 | -.459 | -1.836+ |
| Agreeableness | -.095 | 34 | -.392* | 34 | | |
| Conscientiousness | -.250 | 34 | -.404* | 34 | | |

+ p < .10, * p < .05, ** p < .01, two-tailed

**TABLE 4:** Extreme groups on the personality dimensions of the NEO-FFI: Correlations between subject's ESP performance and the average sferics activity in the 24 hours preceding the session.

For each of the groups the Pearson correlations between the 24 hours' average sferics activity (AV24H) and the subjects' ESP scores were calculated. Where the differences between the respective extreme groups approached significance, this is indicated in the last column of Table 4, as the difference in effect size of the two correlations, the z-score of the difference and its degree of significance.

We note that the sferics-ESP correlation appears most pronounced in the subjects high on Openness (r = -.509), in those low on Neuroticism (r = -.438) and those high on Conscientiousness (r = -.404) and Agreeableness (r = -.392). The group differences between low and high Neuroticism and between high and low Openness are suggestive.

For the interpretation of these differences, the intercorrelations between the personality dimensions of the NEO-FFI, as they occur in our sample, are given in Table 5. The low correlation between neuroticism and openness, r = -.045, means that the findings for these two variables are virtually independent.

| | N | E | O | A | C |
|---|---|---|---|---|---|
| Neuroticism (N) | 1 | | | | |
| Extraversion (E) | -.387 | 1 | | | |
| Openness (O) | -.045 | .149 | 1 | | |
| Agreeableness (A) | -.341 | .143 | .227 | 1 | |
| Conscientiousness (C) | -.293 | .337 | -.181 | -0.023 | 1 |

**TABLE 5:** Intercorrelations between the personality dimensions of the NEO-FFI in our sample (N = 100).

Given the apparent sferics-ESP relationship, it is of interest to examine the functional relationship that may be involved. We give the scatter diagram of combined ESP performance against 24 hours' sferics activity in Figure 2. The drawn line is the locally weighted scatterplot smoothing (lowess, see Wilkinson, 1990) estimate of ESP performance as a function of sferics activity.

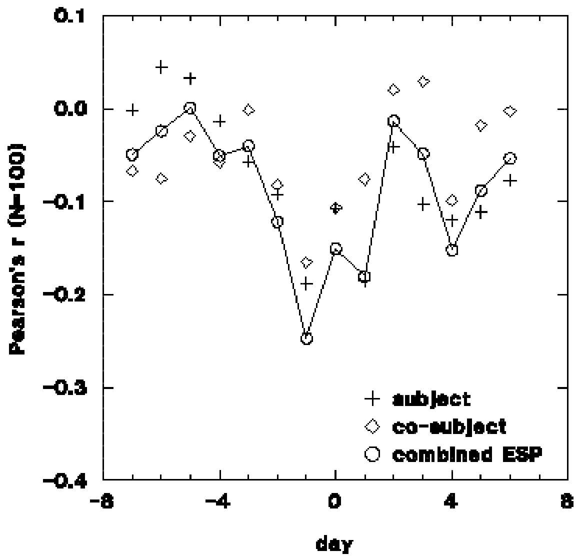


**Figure 2:** Scatterplot of ESP combined score of the session against sferics activity in the preceding 24 h

## DISCUSSION

The present study consists of an analysis of extant ESP data and correlating it with the also extant sferics records. This kind of analysis has been advocated by Irwin (1994) as a stratagem, holding promise to avoid experimenter effects in process-oriented research. It was introduced as 'retrodiction' by Beloff (1986). Retrodiction has also been used extensively in studies of geomagnetic effects; Persinger (1987a) studied the case-collection in 'Phantasms of the living' and, recently, Krippner and Persinger (1996) analyzed data from an outstanding subject in the Maimonides dream telepathy experiments.

The present study explores the possible relationship between sferics activity and ESP performance. We found significant correlations of ESP performance with two of the sferics variables, derived from earlier sferics research. However, the two variables, average sferics activity in the 24 hours preceding the session ($r = -.21$), and its comparison with a baseline level derived from the preceding week ($r = -.20$), are highly correlated ($r = .64$) and therefore largely overlap. In the following we concentrate on the first of these variables.

While two-tailed testing is called for in an exploratory study, we note that the sign of the sferics-ESP correlations is in accordance with findings from other, geomagnetic as well as sferics, studies: The lesser the disturbance by sferics, the higher the ESP performance.

Also, the time-span of the sferics activity that has an apparent influence on the ESP performance shows an interesting behavior. Comparable to studies on weather sensitivity, ESP performance correlates with the sferics activity during the 24 to 48 hours before the ESP session.

The difference between the emotionally stable and neurotic groups of subjects, although only marginally significant ($z = 1.772$, $p = .076$, two-tailed) is interesting with respect to the laboratory studies of sferics as mentioned in the introduction. The emotionally stable group shows an independently significant sferics-ESP correlation with $r = -.438$, $p = .009$, two-tailed.

Moreover, the analogous difference between the 'open' versus 'closed' group is somewhat larger ($z = 1.836$, $p = .066$, two-tailed). The group with high scores on the openness scale of the NEO-FFI reveals a sferics-ESP correlation of $r = -.509$, $p = .0034$, two-tailed. Therefore, the personality dimension of openness appears to be relevant as a modulating variable. This is an interesting finding in the light of, for instance, the conclusion by Broughton and Alexander (1995) that "the emerging picture is that Openness seems to facilitate ESP success". At least, it is likely that Openness plays a role, but rather a more complex one than just a correlate of ESP performance.

The relationship between sferics activity and ESP performance appears to follow a pattern similar to that found in previous studies on the effects of simulated sferics on the EEG. Furthermore, our findings seem to point to a clear-cut dependency at the lower levels of sferics activity, while at higher levels no clear relationship can be inferred. This suggests that a 'disturbance' model of sferics activity is relevant. Moreover, taking this suggestion at face value, it would mean that above a relatively low level, the disturbing effect reaches saturation. A saturation at a low level of sferics activity would be highly relevant for future research, for studies on natural sferics as well as for laboratory studies on the effect of simulated sferics.

## REFERENCES

Beloff, J. (1986). Retrodiction. *Parapsychology Review*, 17(1), 1-5.

Betz, H.D., Schandry, R., Leopold, Ch., Oettinger, W.P., Berg, H., Kulzer, R. & Tritschler, J. (1996). *Sensitivity of humans to low-frequency magnetic fields.* Unpublished manuscript, Ludwig-Maximilians-University, Munich, Dept. of physics.

Borkenau, P., Ostendorf, F. (1993) *NEO-Fünf-Faktoren Inventar (NEO-FFI).* Göttingen: Hogrefe.

Broughton, R.S. & Alexander, C.H. (1995). Autoganzfeld II: the first 100 sessions. *Proceedings of the 38th Annual Convention of the Parapsychological Association* (Durham, N.C., August 5-8, 1995).

Costa, P.T., McCrae, R.R. (1992) *The NEO personality inventory manual.* Odessa, FL: Psychological Assessment Resources.

Gaddum, J.H. (1945) Lognormal distributions. *Nature*, 156, 463-466.

Haraldsson, E. (1993). Are religiosity and belief in an afterlife better predictors of ESP performance than belief in psychic phenomena? *Journal of Parapsychology*, 57, 259-273.

Haraldsson, E. & Houtkooper J.M. (1992). The effects of perceptual defensiveness, personality and belief on extrasensory perception tasks. *Personality and Individual Differences*, 13(10), 1085-1096.

Irwin, H.J. (1994) *An introduction to parapsychology. (2nd edition)*. Jefferson, NC: McFarland.

Krippner, S. & Persinger, M.A. (1996). Enhanced congruence between dreams and distant target material during periods of decreased geomagnetic activity. *Journal of Scientific Exploration*, 10, 487-493.

Laaber, M. (1987) *Einfluss verschiedener Umweltparameter auf das Aufmerksamkeits-Konzentrationsverhalten von Schulkindern unter besonderer Beachtung der Spherics*. Doctoral dissertation, University of Vienna.

Ludwig, H.W. (1973) Wirkung einer nächtlichen Abschirmung der elektrischen Feldstärke bei Rheumatikern. *Archiv für Meteorologie, Geophysik und Bioklimatologie*, 21, 305-311.

Makarec, K. & Persinger, M.A. (1987). Geophysical variables and behavior: XLIII. Negative correlation between accuracy of card-guessing and geomagnetic activity: A case study. *Perceptual and Motor Skills*, 65, 105-106.

Mischo, J., Boller, E., & Braun, G. (1993). Fragebogenuntersuchung zur Erfassung von okkulten Glaubenshaltungen und Merkmalen schizotypischer Verarbeitung. (Unpublished report, Institut für Grenzgebiete der Psychologie und Psychohygiene, Freiburg i.Br.)

Morris, R.L., Dalton, K., Delanoy, D.L. & Watt, C. (1995). Comparison of the sender/no sender condition in the ganzfeld. *Proceedings of the 38th Annual Convention of the Parapsychological Association* (Durham, N.C., August 5-8, 1995).

Palmer, J.A. (1977). Attitudes and personality traits in experimental ESP research. In: Wolman, B.B. (Ed.), *Handbook of Parapsychology*. New York: Van Nostrand Reinhold. Pp. 175-201.

Pelz, J. & Swantes, H.J. (1986). Statistische Untersuchungen über das Auftreten von Stumpf- und Phantomschmerzen, sowie ihre mögliche Abhängingkeit von luftelektrische Erscheinungen. *Kleinheubacher Berichte*, 29, 367-275.

Persinger, M.A. (1974). *The paranormal: Part II. Mechanisms and models. N*ew York: MSS Information.

Persinger, M.A. (1987a). Spontaneous telepathic experiences from *Phantasms of the Living* and low global geomagnetic activity. *Journal of the American Society for Psychical Research*, 81, 23-36.

Persinger, M.A. (1987b). Geopsychology and geopsychopathology: Mental processes and disorders associated with geochemical and geophysical factors. *Experientia*, 43, 92-104.

Persinger, M.A. (1989). Psi phenomena and temporal lobe activity: the geomagnetic factor. In: Henkel, L.A. & Berger, R.E. (Eds.) *Research in Parapsychology 1988*, 121-156.

Persinger, M.A. & Krippner, S. (1989). Dream ESP experiments and geomagnetic activity. *Journal of the American Society for Psychical Research*, 83, 101-116.

Reiter, R. (1960). *Meteorobiologie und Elektrizität der Atmosphäre.* Leipzig: Geest & Portig.

Ruhenstroth-Bauer, G., Baumer, H., Burkel, E.M., Sönning, W. & Filipiak, B. (1985). Myocardial infarction and the weather: A significant positive correlation between the onset of heart infarct and 28 kHz atmospherics - a pilot study. *Clinical Cardiology,* 8, 149-151.

Schienle, A., Stark, R., Kulzer, R., Klöpper, R. & Vaitl, D. (1996). Atmospheric electromagnetism: Individual differences in brain electrical response to simulated sferics. *International Journal of Psychophysiology*, 21, 177-188.

Schienle, A., Stark, R., Kulzer, R., Walter, B. & Vaitl, D. (1997). Effects of low-frequency magnetic fields on electrocortical activity in humans: A sferics simulation study. *International Journal of Neuroscience*, 90, 21-36.

Schmidt, H. (1976). PK effect on pre-recorded targets. *Journal of the American Society for Psychical Research*, 70, 267-291.

Spottiswoode, S.J.P. (1990). Geomagnetic activity and anomalous cognition: A preliminary report of new evidence. *Subtle Energies*, 1, 91-102.

Wilkinson, L. (1990). *SYSTAT: The system for statistics*. Evanston, IL: Systat Inc.

# WORKING WITH RAMTHA: IS IT A "HIGH RISK" PROCEDURE?[1]

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## ABSTRACT

Seven research participants who had worked with the consciousness training procedures taught by the alleged discarnate entity "Ramtha" for 5 years or more, were administered a series of psychological tests. The resulting profile indicated that they were characterized by "thin boundaries," high absorption capabilities, and high dissociative capacities, a profile consistent with Wickramasekera's description of individuals in the "high risk" category for mind-body incongruence and\or somatization. Because of their "high risk" profiles, we would advise that these individuals, and those who engage in similar practices, continually monitor their psychological and physiological health, paying special attention to such variables as diet, exercise, rest, and attitude. We further advise that their vocational, avocational, and social activities be designed to provide equilibrium in light of their endeavors. Finally, we hope that these individuals will continue to collaborate with serious investigators of human consciousness including parapsychologists. In the meantime, we propose that experiences that Westerners label "dissociative" may have once served adaptive, survival functions in human evolution, and may continue to enhance adaptive behavior in any number of non-Western societies.]

## INTRODUCTION

Although the study of anomalous phenomena has emphasized experimental research studies in recent decades, the literature contains several examples of controlled observations of research participants known as "mediums," "psychics," or --perhaps most appropriately-- "psychic claimants." The effects observed in the presence of these individuals included the apparent anomalous production of raps, voices, and other sounds; the apparent anomalous movement of tables or small objects on a table or other surface; the apparent alteration of photographic film; the apparent anomalous appearance and disappearance of objects; and the apparent anomalous

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"channeling" of information and inspirational comments (Schmeidler, 1977, 1990).

When given the opportunity to work with purportedly remarkable research participants, serious scientists have been ambivalent. Haraldsson and Houtkooper (1994) have outlined the value and limitations of working with these individuals who are often dubbed "star performers," i.e., research participants who allegedly manifest dramatic phenomena. The possibility of fraud is omnipresent, and many of these "stars" have earned a reputation for being "difficult," refusing to perform under controlled conditions or with magicians present, invoking demands that scientists consider unwarranted, and making outrageous claims about the "scientific verification" of their abilities once the research has ended. Rush (1977) concluded that the demonstrations by "star performers," even granting their validity, "have not advanced scientific understanding of the phenomena very much" (p. 48). Murphy (1969) admitted that the more gifted these individual are, the greater the difficulties are in studying them. Wiseman and Morris (1995), however, point out that "the study of psychic claimants could prove important" (p. 12); like creativity, putative psi ability may best be studied at the extreme end of the normal distribution curve rather than as it occurs in the general population.

With these caveats --and possibile benefits-- in mind, we accepted an invitation to initiate a research study with JZ Knight and her associates in Yelm, Washington in 1996. Knight (1987) has described her first encounter with the alleged entity "Ramtha" following a 1977 demonstration of so-called "pyramid power" in her kitchen. After placing a paper pyramid over her head she recalls noticing a "glimmer of a bright light" and seeing "a giant man...aglow" who announced himself as "Ramtha, the Enlightened One" (pp. 11-12).

Later, Ramtha (1986) described himself as part of "an unseen brotherhood" who loves humanity (p. 1), telling Knight that she was to be a "channel" for his messages. As Knight began to "channel" Ramtha's words for audiences, he explained that "to prevent you from worshiping me, I have not come to you in my own embodiment. Instead, I have chosen to speak to you through an entity who was my beloved daughter when I lived upon this plane....When I speak to you, she is no longer within her body, for her soul and spirit have left it completely" (p. 2). (In light of this claim, this paper will employ the usage "Ramtha's advice" or "according to Ramtha" instead of "according to Ramtha, speaking through Knight.")

From the viewpoint of at least one debunker, Knight is "probably the best-known and most financially successful of the modern channelers" and Ramtha's advice has become "more puritanical and negative" over time (Alcock, 1996, p. 157). However, the same debunker claims that Ramtha purports to have "conquered the entire world thirty-five thousand years ago," a statement at variance with Ramtha's (1986) statement that he "conquered three-quarters of the known world" (p. 2), a discrepancy that casts doubt on the accuracy of the remainder of this derisive assessment.

Over the years, Ramtha has prescribed a series of exercises that purport to help people “focus” their attention and heighten their untapped capacities. Specifically, these capacities would be described by parapsychologists as “psi phenomena,” specifically telepathy, clairvoyance, precognition, and psychokinesis.

This program attempts to activate “kundalini energy,” a construct that has had various meanings over the millennia it has been used. Ramtha uses the term to describe a reservoir of energy that can be moved from the lower part of the body to the brain's frontal lobe through breathing exercises. Students assume a “half lotus” posture with their eyes closed, legs folded, and buttocks elevated slightly. Students straighten the spine and picture themselves as being pyramids, the forehead being at the apex. Students then attempt to visualize a red line running from the forehead to the right knee, and then to the left knee, and back to the forehead. Students attempt to visualize a red thread slowly unwinding from the forehead to the right knee. As this thread unwinds, the extended index and middle fingers of the right hand trace the movement of the red line on the forehead (Melton, 1997).

Students then tighten the lower part of the body and take a deep breath inward through the nose, expelling that breathe with great force. While breathing in this manner, the back of the tongue is placed on the roof of the mouth, constricting the air flow and generally making the turbulent sound of a rushing airflow. At this point, Ramtha often instructs students to visualize a volcano that spews lava just as the air is exhaled. Each completed cycle of this process is an individualized breath. Students often repeat the phrase, “So be it,” accompanying the statement with a movement in which the right hand, already in front of the body, is quickly brought to the right side at shoulder height with the palm facing forward. This process is usually accompanied by music thought to be energizing (Melton, 1997).

Finally, this alleged activation of kundalini is brought together with practical work on one's life transformation. Beginning students are invited to list various changes they would like to make, or to catalog what is missing from their lives. A word is chosen from each item on the list, and the student “focuses” upon the word holding it in the “mind's eye,” i.e., what Ramtha considers the brain's frontal lobe. After students feel comfortable with their “focus” upon the word, it is held in awareness while breathing; as the breath is discharged, the letters of the word are expelled, one at a time. Ramtha tells students that the breathing facilitates an altered state of consciousness, one that assists the “manifestation” of the life change by unconsciously anchoring the hoped-for transformation. This process is accompanied by biochemical changes in the body, specifically a lowering of bodily acidity (Melton, 1998).

Ramtha (1986) has expressed an interest in systematic research into these phenomena, forecasting that “scientific developments will bloom here greater than they ever have” (p. 3). It was in the spirit of this comment and the cooperation of JZ Knight that we undertook this investigation.

## RESEARCH QUESTION AND PROCEDURE

The research team consisted of Stanley Krippner (SK), Ian Wickramasekera (IW), and Judy Wickramasekera (JW). Research participants consisted of JZ Knight and six individuals living in Yelm who have studied at the Ramtha School of Enlightenment for five years or more: Brett Alt, J.O. Alt, Bodhananda, Joe Dispensa, Greg Simmons, and Audrey Wolf. The 7 research participants (five men, two women, ranging in age from 26 to 57 with a mean age of 39.5) were administered a series of psychological tests. Only Knight claims to "channel" Ramtha; the others practice the prescribed kundalini meditation exercises.

The framework guiding our research project was Wickramasekera's (1988, 1989, 1991, 1995) multidimensional High Risk Model of Threat Perception (HRMTP) designed to identify persons at risk for mind-body incongruence. Wickramasekera (1989, 1995, 1993, 1998, in press; Wickramasekera, Pope, and Kolm, 1996) has amassed considerable data in support of the HRMTP model, and found 71% of one high risk group (high hypnotic ability people) to report anomalous experiences in comparison with 19% of another high risk group (low hypnotic ability people). This quantitative discrepancy in "lows" is hypothesized to be due to an active inhibitory cognitive style that blocks access to implicit or unconscious (Kihlstrom, 1987) perceptions (Wickramasekera, 1988, 1993). Wickramasekera's model predicts that (1) the capacity to enter an altered state of consciousness, and (2) the capacity to block the perception of threat from consciousness, are I{preconditions} for the development of both somatization disorders and presumptive psi abilities, especially anomalous healing.

All 7 research participants were administered the Absorption Subscale of the Differential Personality Questionnaire (DPQ) (Tellegen, 1977), the Dissociative Experiences Scale (DES) (Bernstein & Putnam, 1986), and the Boundary Questionnaire (BQ) (Hartmann, 1989). The DPQ and the DES are both measures of the capacity to enter an altered state of consciousness (Frischholz et al., 1980; Rosen & Petty, 1994; Tellegen & Atkinson, 1974), which permits the temporary inhibition of threatening perceptions and memories from conscious awareness. The BQ was added because of its suspected relationship to dissociation and its inclusion of several questions relating to purported psi experiences.

The Absorption Subscale of the DPQ was designed to tap openness to absorbing and self-altering experiences (Tellegen & Atkinson, 1974). Several research studies have demonstrated its utility in predicting the reliability with which individuals can enter altered states of consciousness and produce psychophysiological changes in their own bodies (e.g., Roche & McConkey, 1990). The absorption scale has been shown to correlate with hypnotic ability (Tellegen & Atkinson, 1974). Irwin's (1985) survey of subjective anomalous experiences (e.g., apparitions, ESP experiences, out-of-body experiences, past-life experiences) suggests both a capacity and an opportunity for absorption on the part of the experients. Some support was given to this thesis by the results of a ganzfeld study that explored arousal level and ESP performance (Stanford, Angelini, & Raphael, 1985).

The DES is a 28-item self-report questionnaire with a test-retest reliability of .84, split-half reliabilities ranging from .71 to .96, good internal consistency, and good construct validity (e.g., Bernstein & Putnam, 1986). It inquires as to the frequency of dissociative experiences in the daily lives of respondents. A score of 30 or above is regarded as characterizing those who are "severely dissociative" (Carlson & Putnam, 1993), but only 17% of this number have been later diagnosed as suffering from dissociative identity disorder (Carlson, Putnam, Ross, Torem, Coons, Dill, Loewenstein, & Braun, 1993). Kirmayer (1994) regards the DES as "the most psychometrically adequate and widely used measure of dissociative phenomena" (p. 96).

The Boundary Questionnaire (Hartmann, 1989) was constructed to measure the personality dimensions referred to as "thin boundaries" and "thick boundaries." For example, "thin boundaried" adults often are open, sensitive, and vulnerable; tend to experience "twilight" states of consciousness easily," and typically involve themselves in relationships quickly. In general, they do not repress uncomfortable material or isolate thought from feeling; not do they have ready access to the various defense mechanisms by which "thick boundaried" people defend themselves. There are advantages and disadvantages to both "thin boundaries" and "thick boundaries." "Thin boundaried" people are open and creative in certain ways but may get lost in fantasy and might be emotionally vulnerable. "Thick boundaried" people are adaptive in making one well-organized, punctual, reliable, responsible, and efficient, but may make one rigid and unable to change. Neither condition, by itself, can be considered pathological (Hartmann, 1991, pp. 188-189).

Validity data on the questionnaire has been supplied by Hartmann (1991, pp. 250-254) who notes that it correlates predictably to several scales on other personality tests (e.g., the MMPI) and has been able to discriminate nightmare sufferers (pp. 67-68). It comprises 145 items, divided into 12 I{a priori} categories, each of which was utilized for statistical purposes in this study. In addition, all the questionnaire items pertaining to reported "psychic experiences" were totaled to create a category we thought would be especially pertinent for the Yelm group. Such items included, "I see auras or fields of energy around people" and "I have had dreams that later come true." A few additional items were added to this category, e.g., "I have had clairvoyant experiences during which I seemed to be aware of distant events."

The framework guiding our research project was Wickramasekera's (e.g., 1988, 1995) multidimensional High Risk Model of Threat Perception (HRMTP) designed to identify persons at risk for mind-body incongruence. Wickramasekera (1989, 1995, 1993, Wickramasekera, Pope, & Kolm, 1996) has amassed considerable data in support of the HRMTP model, and found 71% of one high risk group (high hypnotic ability people) to report anomalous experiences in comparison with 19% of another high risk group (low hypnotic ability people). This quantitative discrepancy in "lows" is hypothesized to be due to an active inhibitory cognitive style that blocks access to implicit or unconscious (Kihlstrom, 1987) perceptions (Wickramasekera, 1988, 1993).

Over the years, Wickramasekera has attempted to identify four predisposing high risk factors: hypnotic ability, excessive catastrophizing, high negative affect, and high Marlowe Crowne (Crowne & Marlowe, 1964) scores (i.e., people unable to perceive threat). These predisposing factors amplify the probability that the two triggering high risk factors, major life changes and multiple “hassles,” will generate dysfunctional symptoms unless their impact is reduced by the buffering high risk factors, social support, and coping skills. It is hypothesized that people who are high on the predisposing risk factors hypnotic ability are (1) hypersensitive to both sensory and anomalous phenomena, (2) prone to surplus empathy and boundary problems, and (3) also prone to surplus pattern recognition or the tendency to find meaning in randomly distributed events.

If high risk patients anguish about their high frequency presumptive parapsychological experiences, Wickramasekera (1988, 1993) reframes their concerns, helping them to assimilate the incidents comfortably. Typically, this process is followed by an attendant decrease in psychological and physical symptoms and medical costs (Wickramasekera, 1988, 1993). We suspect that his high risk factors characterizes many mediums and healers, as well as clients who make remarkable recoveries (e.g., Hirshberg & Barasch, 1995) demonstrating the model's usefulness in the study of anomalous healing. Therefore, we asked if the test scores of our research participants would resemble those at “risk” for somatization, admitting that the limitations of our study included only three of several potential measures and a small number of research participants.

## RESULTS

### Absorption Subscale

The raw scores on the Absorption Subscale ranged from 19 to 33, with percentile equivalents ranging from 45% to 98%. The mean score was 28.6 (85%). In other words, all 7 members of the Yelm group obtained scores that were in or near the top half of the expected distribution. This test correlates modestly with hypnotic ability, and both high and low hypnotizability characterize somaticizers.

### Dissociative Experiences Scale

The raw scores on the DES ranged from 12 to 46, with a mean of 31.1. There were four scores above 30, which is regarded as the cutoff point for those who are “severely dissociative,” but it must be noted that only 17% of those who make these scores are later diagnosed as clinical cases of dissociative identity disorder. Of course, this does not rule out the possibility that some of the individuals in this group would be candidates for clinical diagnosis and treatment despite their ability to function well in this particular setting.

### Boundary Questionnaire

The mean total score for the Yelm group was 343, indicating “very thin boundaries,” as average scores range between 250 and 300 (Hartmann, 1991). The only two groups tested by Hartmann who have received comparably high scores are college music students and people reporting frequent nightmares (Hartmann, personal communication, October, 1996; Hartmann, Elkin, & Garg, 1991). The mean score for each category appears in Table 2 as well as the general population's mean score for purposes of comparison.

Category 1 (Sleep, wake, dream): 25 (population mean: 15.8)
Category 2 (Unusual experiences): 38 (population mean: 25.6)
Category 3 (Thoughts, feelings, moods): 39 (population mean: 29.2)
Category 4 (Childhood, adolescence, adulthood): 13 (pop. mean: 11.2)
Category 5 (Interpersonal): 29 (population mean: 25.6)
Category 6 (Sensitivity): 13 (population mean: 12.8)
Category 7 (Neat, exact, precise): 25 (population mean: 20.3)
Category 8 (Edges, lines, clothing): 43 (population mean: 37.1)
Category 9 (Opinions about children and others): 26 (pop. mean: 20.7)
Category 10 (Opinions about organizations, relationships): 29 (population mean: 23.4)
Category 11 (Opinions about people, nations, groups): 41 (population mean: 34.6)
Category 12 (Opinions about beauty, truth): 22 (population mean: 18.4)

Total Score: 343 (Psychic experiences category excluded)

Psychic Experiences Category: 21 (maximum possible score: 32)

**Table 1:** Mean Scores for Yelm Group on Boundary Questionnaire

### Correlations between tests

The Pearson product moment coefficient correlation ( I{r}) was used to determine if there were statistically significant relationships between the various test scores (Tables 2 and 3). The relationship between the DES and the Absorption Subscale was .88; the relationship between the DES and the total score on the Boundary Questionnaire was .78; the relationship between the Absorption Subscale and the total score on the Boundary Questionnaire was .68. The first two of the three correlations are significant at the .01 level (2-tailed, 5 df). The latter correlation ( I{p}=.10) is not significant.

The Absorption Subscale correlated positively and significantly (beyond the .05 level, 2-tailed, 5 df) with Boundary categories reflecting reports of “psychic experiences”; having “unusual experiences”; “scoring thin” on thoughts, feelings, and moods; and “scoring thin” on opinions about beauty and truth. The correlation with the added “psychic experiences” category was extremely high, significant beyond the .02 level (2-tailed, 5 df), indicating the importance of studying the incidence of such purported events as precognition and out-of-body experiences.

| Boundary category | r (with Absorption Subscale) | p |
|---|---|---|
| Category 1 | .70 | ns |
| Category 2 | .83 | .05 |
| Category 3 | .80 | .05 |
| Category 4 | .45 | ns |
| Category 5 | -.20 | ns |
| Category 6 | .22 | ns |
| Category 7 | .23 | ns |
| Category 8 | -.04 | ns |
| Category 9 | .14 | ns |
| Category 10 | -.40 | ns |
| Category 11 | -.54 | ns |
| Category 12 | .79 | .05 |
| Total score | .68 | ns |
| Psychic experiences | .84 | .02 |

**Table 2:** Correlations **(r)** between Boundary categories and Absorption Subscale scores

| Boundary category | r (with DES scores) | p |
|---|---|---|
| Category 1 | .80 | .05 |
| Category 2 | .90 | .01 |
| Category 3 | .88 | .01 |
| Category 4 | -.40 | ns |
| Category 5 | -.46 | ns |
| Category 6 | .52 | ns |
| Category 7 | .06 | ns |
| Category 8 | -.19 | ns |
| Category 9 | .22 | ns |
| Category 10 | -.07 | ns |
| Category 11 | -.32 | ns |
| Category 12 | .75 | .05 |
| Total score | .78 | .05 |
| Psychic experiences | .82 | .05 |

**Table 3:** Correlations **(r)** between Boundary categories and DES scores

The DES correlated significantly (at the .05 level, 2-tailed, 5 df) with Boundary categories reflecting reports of “psychic experiences”; awareness of sleep, waking, and dreaming experiences; and “scoring thin” on opinions about beauty and truth. Two correlations were significant beyond the .01 level (2-tailed, 5 df): having “unusual experiences” and “scoring thin” on thoughts, feelings, and moods. Hence, “thin boundaried” people making high scores on these categories also may be expected to make high scores on measures of dissociation, i.e., a gap or disturbance in one's ordinary integrative patterns of memory, self-identity, or perception (Kirmayer, 1994, p. 114).

The categories on the Boundary Questionnaire that failed to attain significance when correlated with either of the other two tests were: “childhood, adolescence, and adult experiences”; “interpersonal relationships”; “sensitivity”; “neat, exact, and precise”; “edges, lines, and clothing”; “opinions about children and others”; “opinions about organizations and relationships”; and “opinions about people, nations, and groups.” Even though the small number of respondents tested prevents us from coming to any firm conclusions regarding these data, several findings are intriguing enough to warrant further study with larger samples.

The Boundary categories that correlated significantly with I{both} the Absorption Subscale and the DES were reporting “psychic experiences”; having “unusual experiences”; “scoring thin” on thoughts, feelings, and moods; and “scoring thin” on opinions about beauty and truth. Each of these three categories are common characteristics of “thin-skinned” individuals. The addition of the “psychic experiences” Boundary category was justified, given its significant correlations with both the Absorption Subscale and the DES; this category might be used with salubrious results in parapsychological research. (Because this category is composed of items from several parts of the Boundary Questionnaire as well as additional items, it not an independent category.)

## DISCUSSION

This investigation marks the first time that the Boundary Questionnaire, the Absorption Subscale, and the DES have been given to the same people, although Barrett (1989) had previously reported a significant relationship between the Absorption Subscale and Total Score on the Boundary Questionnaire, a finding repeated in this study. Richards (1996) administered the Boundary Questionnaire to participants in a “interpersonal psychic training” program, finding a significant association between subjectively perceived success in the program and “scoring thin” on the Boundary Questionnaire.

Ryan and Ross (1988) found that reported psychic experiences clustered with several diagnostic criteria for dissociative disorders among a sample of college students, but Ross (1989, p. 194) did not find notable degrees of dissociative psychopathology among 11 alternative healers and therapists. This group, however, did report more psychic experiences than a comparison group of psychiatry residents (p. 184). Pekala, Kumar, and Marcano (1995) administered the DES and the Harvard Group Scale of Hypnotic Susceptibility as well as an inventory of anomalous experiences to 413 volunteer subjects, reporting that both dissociative ability and hypnotic susceptibility were important in predicting who would report anomalous experiences, with dissociative ability being somewhat more important.

Richards (1991) used the DES in a study of correlations between subjective “psychic” experiences (e.g., “telepathy,” “clairvoyance,” “past lives”) and dissociation in a non-clinical adult population of 184 subjects. There was a statistically significant relationship between DES scores and most of the “psychic” experiences reported. Richards, in agreement with Ross, concluded that these experiences “are a common occurrence in non-clinical populations, and...although they are correlated with dissociation, they are not necessarily associated with pathology” (p. 83). The only experimental study on anomalous phenomena that employed the DES was conducted by Palmer (1994) with 40 volunteer subjects. For those who scored above the mean on the DES, there was a positive correlation between ESP scores and trait anxiety in one condition of his experiment, one that attempted to introduce an emotionally-toned element into the ESP task.

The number of significant relationships in this study was obtained from a very small sample, thus demonstrating the utility of this line of research. For example, the Boundary Questionnaire could be administered as a followup to the DES to help identify high DES-scorers who “score thin” but do not suffer from dissociative identity disorder. Hartmann (1991) suspects that both genetic and environmental factors are involved in the development of “thick boundaries” and “thin boundaries” (pp. 112-121).

The data suggest that these three measures, in whole or in part, tap into the personality dimensions that characterize body/mind incongruence. It is likely that the common construct measured by these separate tests is a capacity to readily enter into altered states of consciousness. This suggestion is not made only on the basis of this study and its small number of research participants but on the basis of research involving larger numbers of subjects with many of these same personality measures (e.g., Tellegen & Atkinson, 1974; Wickramasekera, 1986b).

A frequently asked question is whether Ramtha represents an “alter personality” of JZ Knight. Whatever Ramtha may or may not be (e.g., a discarnate entity, a subpersonality, a social role taken by Knight), his appearance bears some resemblance to the phenomena observed during “switching” in people diagnosed as having a dissociative identity disorder. As a result of the “channeling” process, JZ Knight exhibits the “striking gaps in awareness, memory, or identity” that characterize the domain of dissociation (Kirmayer, 1994, p. 92). According to the American Psychiatric Association (1994, p. 477), amnesia is the critical factor in the diagnosis of dissociative identity disorder, and Knight claims to be amnesic for Ramtha's appearances. However, she has access to Ramtha through a voluntarily-induced procedure, whereas the “multiples” afflicted with dissociative identity disorder are taken unaware by their “alters.” As a result, the possibility that Ramtha is an “alter personality” can not be answered definitively on the basis of the data available to us. On the other hand, a useful control would be for an accomplished actor to attempt to simulate these changes under the same conditions, using the same equipment.

There is considerable cross-cultural literature indicating that dissociative abilities, per se, are not necessarily pathological and may even be adaptive (Braude, 1995; Krippner, 1997). There is less demand for behavioral continuity, consistency, and rationality in many non-Western cultures than in Western societies (Kirmayer, 1994, p. 107; Ross, 1989). In these non-Western cultures, the phenomena associated with JZ Knight and Ramtha most likely would be honored, admired, and put to use by the community for purposes of divination, counseling, and healing. It would be a gross misinterpretation of our data for the research participants to be pathologized on the basis of their "thin boundaries" and their high dissociation and absorption scores.

The research participants from Yelm who participated in this study appear to be candidates for Wickramasekera's "high risk" group on the basis of their "thin boundaries," absorption capabilities, and dissociative capacities. But these potentials need not be categorized as negative or pathological. With the proper social support and coping skills, this group could maintain their current abilities without adverse reactions, even utilizing the self-regulation they have learned for maintaining their well-being and making rapid recoveries from various ailments and indispositions.

The direction of causation can not be determined from this study. Do people in this training program learn how to elicit altered states of consciousness more readily, or were they attracted to the program because they had such capacities before the program began? Longitudinal research is needed to answer this question. In addition, it should be noted that numerous correlation coefficients were computed, thus some significant correlations might be spurious. Future research along these lines should utilize statistical procedures that correct for multiple testing.

## CONCLUSION

The willingness of these 7 research participants to cooperate in this study yields data with important clinical and theoretical implications. Because of their "high risk" profiles, we would suggest that they continually monitor their psychological and physiological health, paying special attention to such variables as diet, exercise, rest, and attitude. It would also be important that their vocational, avocational, and social activities be designed to provide some balance for their endeavors at the Ramtha School of Enlightenment. Their verbal reports indicate that Ramtha's teachings have played a crucial role for them, one that they indicate has been life-affirming. We hope that they will continue to collaborate with serious investigators of human consciousness because the results could be mutually beneficial.

Although no systematic investigation was made, it was our impression that the research participants were functioning well in society, either in their local communities or in administrative positions at the Ramtha School of Enlightenment. Krippner (1997) has stated that dissociative experiences are not inevitably uncontrolled and dysfunctional. In fact, based on clinical psychophysiological theory and empirical research, Wickramasekera (1986a, 1986b, 1988, 1993) has also hypothesized that high hypnotic ability, a construct that includes dissociation (Hilgard, 1977), if recruited and focused on "transcendent goals and ideals" (Wickramasekera, 1988, p. 70) can give these high risk people a competitive edge in adaptation over their contemporaries of lesser hypnotic ability. Hence, data and theory from cross-cultural studies and the clinical psychophysiological domain converge on the same conclusion: that adaptive recruitment of these exceptional abilities (dissociation, hypnotic ability) can be highly functional.

Experiences that Westerners label "dissociative" may have once served adaptive, survival functions in human evolution, and they continue to enhance adaptive behavior in any number of non-Western societies (Krippner, 1997). It is possible that Western societies suppress this natural and valuable capacity at their peril. The Ramtha School of Enlightenment may be one of several institutions that is actively preserving a capacity that could be of adaptive value for certain populations in the future.

## REFERENCES

Alcock, J.E. (1996). Channeling. In G. Stein (Ed.), *The encyclopedia of the paranormal* (pp. 153-160). Amherst, NY: Prometheus Books.

American Psychiatric Association (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: American Psychiatric Association.

Barrett, D. (1989, April). The relationship of thick and thin boundaries to hypnotic susceptibility. Paper presented at the annual convention of the Eastern Psychological Association, Boston, MA.

Bernstein, E.M., & Putnam, F.W. (1986). Development, reliability, and validity of a dissociation scale. *Journal of Nervous and Mental Disease*, *174*, 727-735.

Braude, S.E. (1995). *First person plural: Multiple personality and the philosophy of mind* (rev. ed.). Lanham, MD: Rowman & Littlefield.

Carlson, E.B., & Putnam, F.W. (1993). An update on the Dissociative Experiences Scale. *Dissociation*, *6*, 16-27.

Carlson, E.B., Putnam, F.W., Ross, C.A., Torem, M., Coons, P., Dill, D., Loewenstein, R.J., & Braun, B.G. (1993). Validity of the Dissociative Experiences Scale in screening for multiple personality disorder: A multicenter study. *American Journal of Psychiatry*, *150*, 1030-1036.

Crowne, D.P., & Marlowe, D. (1964). *The approval motive*. New York: John Wiley & Sons.

Frischholtz, E.J., Tyron, W.W., Vellios, A.T., Fisher, S., Maruffi, B.L., & Spiegel, H. (1980). The relationship between the Hypnotic Induction Profile and the Stanford Hypnotic Susceptibility Scale, Form C: A replication. *American Journal of Clinical Hypnosis*, *22*, 185-196.

Haraldsson, E., & Houtkooper, J.M. (1994). Report on an Indian swami claiming to materialize objects: The value and limitations of field observations. *Journal of Scientific Exploration*, *8*, 381-397.

Hartmann, E. (1989). Boundaries of dreams, boundaries of dreamers: Thin and thick boundaries as a new personality measure. *Psychiatric Journal of the University of Ottawa*, *14*, 557-560.

Hartmann, E. (1991). *Boundaries in the mind*. New York: Basic Books.

Hartmann, E., Elkin, R., & Garg, M. (1991). Personality and dreaming: The dreams of people with very thick or very thin boundaries. *Dreaming*, *1*, 311-324.

Hilgard, E.R. (1977). *Divided consciousness: Multiple controls in human thought and action*. New York: John Wiley & Sons.

Hirschberg, C., & Barasch, M.I. (1995). *Remarkable recovery*. New York: Riverhead.

Irwin, H. (1994). The phenomenology of parapsychological experience. In S. Krippner (Ed.), *Advances in parapsychological research* (vol. 7, pp. 10-76). Jefferson, McFarland.

Irwin, H. (1985). Parapsychological phenomena and the absorption domain. *Journal of the American Society for Psychical Research, 79*, 1-11.

Kirmayer, L.J. (1994). Pacing the void: Social and cultural dimensions of dissociation. In D. Spiegel (Ed.), *Dissociation: Culture, mind, and body* (pp. 91-122). Washington, DC: American Psychiatric Press.

Knight, JZ. (1987). *A state of mind: My story*. New York: Warner.

Krippner, S. (1997). The varieties of dissociative experience. In S. Krippner & S. Powers (Eds.), *Broken images, broken selves: Dissociative narratives in clinical practice* (pp. 336-361). New York: Brunner/Mazel.

Melton, G. (1998). *Finding enlightenment:Ramtha's school of ancient wisdom*. Hillsboro: Beyond Words.

Murphy, G. (1969). The discovery of gifted sensitives. *Journal of the American Society of Psychical Research, 63*, 3-20.

Palmer, J. (1994). Explorations with the perceptual ESP test. *Journal of Parapsychology, 58*, 115-147.

Pekala, R.J., Kumar, V.K., & Marcano, G. (1995). Anomalous/paranormal experiences, hypnotic susceptibility, and dissociation. *Journal of the American Society for Psychical Research, 89*, 313-332.

Ramtha. (1986). *Ramtha* (S.L. Weinberg, Ed.). Bellevue, WA: Sovereignty.

Richards, D.G. (1991). A study of the correlations between subjective psychic experiences and dissociative experiences. *Dissociation, 4*, 83-91.

Richards, D.G. (1996). Boundaries in the mind and subjective interpersonal psi. *Journal of Parapsychology, 60*, 227-240.

Roche, S.M., & McConkey, K.M. (1990). Personality processes and individual differences. *Journal of Personality and Social Psychology, 59*, 91-101.

Rosen, E.F., & Petty, L.C. (1994). Dissociative states and disordered eating. *American Journal of Clinical Hypnosis, 36*, 266-275.

Ross, C.A. (1989). *Multiple personality disorder: Diagnosis, clinical features, and treatment*. New York: John Wiley & Sons.

Rush, J.H. (1977). Problems and methods in psychokinesis research. In S. Krippner (Ed.), *Advances in parapsychological research* (Vol. 1, pp. 15-78). Jefferson, NC: McFarland.

Ryan, L., & Ross, C.A. (1988). Dissociation in adolescents and college students. In B.G. Braun (Ed.), *Proceedings of the Fifth International Conference on Multiple Personality/Dissociate States* (p. 19). Chicago: Rush-Presbyterian-St. Luke's Medical Center.

Schmeidler, G.R. (1977). Research methods in psychokinesis. In S. Krippner (Ed.), *Advances in parapsychological research* (Vol. 2, pp. 79-132). Jefferson, NC: McFarland.

Schmeidler, G.R. (1990). PK: Recent publications and an evaluation of quantitative research. In S. Krippner (Ed.), *Advances in parapsychological research* (Vol. 6, pp. 13-53). Jefferson, NC: McFarland.

Stanford, R., Angelini, R.F., & Raphael, A.J. (1984). Cognition and mood during ganzfeld: Effects of extraversion and noise versus silence. *Journal of Parapsychology, 48*, 165-191.

Tellegen, A. (1977). *The Multidimensional Personality Questionnaire*. Minneapolis: National Computing Systems.

Tellegen, A., & Atkinson, G. (1974). Openness to absorbing and self-altering experience ("absorption"), a trait related to hypnotic susceptibility. *Journal of Abnormal Psychology, 83*, 268-277.

Wickramasekera, I. (1986a). Risk factors for parapsychological verbal reports, hypnotizability and somatic complaints. In B. Shapin & L. Coly (Eds.), *Parapsychology and human nature* (pp. 19-35). New York: Parapsychology Foundation.

Wickramasekera, I. (1986b). A model of people at high risk to develop chronic stress related somatic symptoms: Some predictions. *Professional Psychology: Research and Practice, 17*, 437-447.

Wickramasekera, I. (1988). *Clinical behavioral medicine: Some concepts and procedures*. New York: Plenum Press.

Wickramasekera, I. (1989). Is hypnotic ability a risk factor for subjective (verbal report) psi, somatization, and health care costs? In L. Coly & J.D.S. McMahon (Eds.), *Psi and clinical practice* (pp. 184-191). New York: Parapsychological Foundation.

Wickramasekera, I. (1991). Model of the relationship between hypnotic ability, psi, and sexuality. *Journal of Parapsychology, 55*, 159-174.

Wickramasekera, I. (1993). Assessment and treatment of somatization disorders: The high risk model of threat perception. In J.W. Rhue, S.J. Lynn, & I. Kirsch (Eds.), *Handbook of clinical hypnosis* (pp. 587-621). Washington, DC: American Psychological Association.

Wickramasekera, I. (1995). Somatization: Concepts, data and predictions from the high risk model of threat perception, *Journal of Nervous and Mental Disorders, 183*, 15-30.

Wickramasekera, I. (1998, Spring). Out of mind is not out of body: Somatization, the high risk model, and psychophysiological psychotherapy. *Biofeedback*, pp. 8-11, 32.

Wickramasekera, I. (in press). Secrets kept from the mind but not the body or behavior: The unsolved problems of identifying and treating somatizatin and psychophysiological disease. *Advances: The Journal of Mind Body Health*, in press.

Wickramasekera, I., Pope, A.T., & Kolm, P. (1996). On the interaction of hypnotizability and negative affect in chronic pain: Implications for the somatization of trauma. *Journal of Nervous and Mental Diseases, 184*, 628-635.

Wiseman, R., & Morris. R.L. (1995). *Guidelines for testing psychic claimants* Amherst, NY: Prometheus.

# THIRD REPLICATION OF EVENT-RELATED BRAIN POTENTIAL (ERP) INDICATORS OF UNCONSCIOUS PSI[1]

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## ABSTRACT

The objective of this study was to replicate the results of three previous experiments conducted in this laboratory demonstrating that event-related brain potentials (ERPs) differed significantly when elicited by target stimuli than when elicited by nontarget decoys in a precognition task. Study 1 (Warren et al. 1992a) and Study 2 (Warren et al. 1992b) examined ERPs recorded from a gifted psychic, the late Malcolm Bessent. Study 3 (Don et al. 1995) tested a group of 22 subjects selected for their interest and involvement in gambling, but unselected for psi ability. In all three previous studies, nonsignificant guessing accuracy suggested that the differential brain responses we observed reflected an unconscious detection of the psi targets.

In the present study, ERPs were recorded from a new sample of 20 self-reported gamblers performing a computerized, forced-choice guessing task which was part of a larger study of social and problem gambling. On each hand, ERPs were elicited by four playing cards, sequentially presented on a video monitor. After the last card was delivered, subjects guessed which of the four cards would subsequently be selected by a random process as the target for that hand. On the basis of our previous findings, we hypothesized that the Negative Slow Wave (NSW) measured at 150-500 ms post-stimulus would have greater negative-going amplitude over 12 widely distributed scalp sites when elicited by targets than when elicited by nontargets in the nonwager condition.

In an ANOVA performed to test this hypothesis, the main effect of Stimulus Category (target, nontarget) fell just short of significance, $F(1/19) = 2.20$, $p < .08$, one-tailed. The Stimulus Category x Hemisphere interaction was significant, $F(1/19) = 6.30$, $p = .01$, one-tailed. The effect size ($f$) = .56 (Cohen, 1988). As in our previous studies, the present results were interpreted as evidence of unconscious or preconscious psi. That is, although conscious target discrimination did not occur, as indicated by nonsignificant guessing accuracy, differential brain responses to targets and nontargets indicated that psi information was detected by the subjects. Importantly, these results represent a third replication and confirmation of our earlier findings, on an independent sample of subjects unselected for psi abilities.

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## INTRODUCTION

Event-related brain potentials (ERPs), which are coincident with, and superimposed upon, the naturally-occurring EEG rhythms such as theta, alpha, and beta waves, are minute fluctuations in voltage recorded from the surface of the scalp in response to sensory or endogenous events. ERPs occurring from 150 ms or so after event onset can reflect the occurrence of different types of endogenous cognitive activity elicited by the stimuli (Donchin, Ritter & McCallum, 1978). Because ERPs are usually smaller than, and often obscured by the ongoing EEG activity, ERPs are typically observed by averaging the brain's response to numerous, repeated stimuli. Averaging has the effect of enhancing the ERP relative to the ongoing EEG activity. The ERP, which is time-locked to stimulus onset, thus increases, while the background EEG, being random with respect to stimulus occurrence, tends to cancel out over repeated hands. ERPs are measured relative to their amplitude deviation from an average, prestimulus baseline period; their microvolt-range amplitude may be either positive or negative relative to this baseline.

We have reported two previous studies in which ERPs elicited by target and nontarget stimuli were recorded from a selected subject, the late Malcolm Bessent, while he performed a forced-choice task (Warren, McDonough, & Don, 1992a; 1992b). In both of those studies, the ESPerciser, a computer-controlled psi testing system (Psychophysical Research Laboratories, 1985), was modified to present targets and decoys sequentially instead of simultaneously as in the original software version. In both studies, a negative-going ERP measured in the 400-500 ms latency range was larger in response to target stimuli than to nontarget stimuli. In Study 1, the ERP effect was topographically undifferentiated; however, in Study 2, the effect was restricted to the left hemisphere.

Study 3 was performed on a subset of the data from a study of social and problem gamblers. It was undertaken in order to confirm the above ERP effect in a group of subjects unselected for variables known to be related to psi, such as belief in psi or past experience in psi research (Don, McDonough, and Warren, 1995). In Study 3, we tested the hypothesis that the brain wave negativity associated with targets was a more time-extended process than measured by the previous 400-500 ms latency range. Results of Study 3, as well as a re-examination of the earlier data, suggested that the enhanced negative brain wave elicited by targets relative to that elicited by nontargets appeared as early as 150 ms and persisted through 500 ms post-stimulus. The observed effect was widely distributed across the scalp in Study 3.

The present study, Study 4, was designed to replicate Study 3, but incorporated changes in equipment and computer software and some additional manipulations which will be reported at a later date. We posed the experimental hypothesis that the Negative Slow Wave (NSW) measured at 150 to 500 ms post-stimulus onset would have greater negative-going amplitude, i.e., it would be more negative, or less positive, when elicited by targets than when elicited by nontargets over 12 widely distributed scalp sites. The latency range of the Negative Slow Wave was defined *a priori* as 150-500 ms post-stimulus (See Don et. al 1995). The hypothesis was tested on data only from the nonwager condition because of previous work suggesting that the NSW enhancement for targets relative to that of nontargets is absent in the wager condition (See Don et. al 1995). The 12 recording sites we analyzed (F3, F4, C3, C4. P3, P4, F7, F8, T3, T4, T5 and T6) were selected on an *a priori* basis from among the entire 19 channel montage because they rendered good coverage of most of the scalp (and underlying cortex), permitting the analysis of three topographic factors (Hemisphere (left, right) x Lateral-Medial x Anterior-Posterior (frontal, central, parietal)), and avoided both the multiple-testing problems that would occur if all 19 sites were tested individually, and the loss of spatial resolution that would occur if data from several or all sites were averaged together (See Warren et. al 1997). A significance level of % = .05, one-tailed, was adopted for rejection of the alternative null hypothesis because our prediction was directional.

## METHOD

### Subjects

Twenty male and female adults with normal or corrected-to-normal vision were recruited from notices and advertisements. In our recruitment notice, we asked for volunteers who gambled at least once per week, i.e., frequent gamblers. This included all forms of gambling, e.g., playing the lottery, card games with friends, gambling at casinos, playing bingo, sports wagering, horse racing, etc. Subjects were paid $8 per hour for their participation in the experiment and were given $10 credit with which to wager. Most subjects finished within two hours and were paid $16, plus the money remaining in their “kitty,” if any. They were allowed to keep their winnings but owed nothing if their account went negative.

### Stress Task

Prior to participating in the gambling task, half of the subjects performed 40 trials of a simple, “low-stress” version, while the other half performed 40 trials of a complex, “high-stress” version of an arithmetic problem-solving task used by Warren & McDonough (1995). Although the subjects in that study could easily master the simple arithmetic task, they found the complex task to be extremely difficult, frustrating and stressful. Both versions of the problem-solving task, in which subjects try to learn an arithmetic rule relating two numeric stimuli to a criterion value, had the same stimulus and response structure and were performed for the same amount of time (about 20 minutes). Subjects filled-out the modified Mood Adjective Checklist (MACL; Nowlis 1965) before and after the stressor task. Data from subjects receiving either version were pooled for the present analyses.

### Gambling (psi) Task

A computerized guessing task was developed for this study using the Micro Experimental

Laboratory system (MEL) and was modeled after the ESPerciser psi testing system (Psychophysical Research Laboratories, 1985). In the present study, the stimulus set was comprised of a normal deck of fifty-two playing Acards@ presented on a computer monitor. On each trial, or Ahand,@ four playing cards of a given rank were sequentially presented, for example, the four sevens might be presented on one hand (seven of hearts, seven of clubs, seven of spades, and seven of diamonds), the four kings on another, etc. Thus, there were thirteen possible stimulus sets, or Apacks,@ for each hand (two through ace). The four cards stimuli presented on each hand were delivered in the center of the video screen in serial order using an interstimulus interval of 2200 ms and a stimulus duration of 150 ms. The card stimuli were presented in actual size and full color (standard deck) against a black background. The target card for each hand was randomly selected from among the alternatives using a pseudorandom algorithm[1]; the remaining three cards in the pack served as decoys for that hand. Additionally, the target was selected only after the subject made his/her choice for that hand; that is, all hands were conducted in the precognition mode. The pack of cards used on a given hand and the order in which the target card and decoys were presented was also determined randomly.

## Testing Procedure

Each subject was seated on a comfortable, cushioned chair in a pleasantly decorated testing room with sound-attenuating material on the walls and door to reduce distracting noises. During the experiment, the subject sat alone in the testing room; an intercom permitted communications with an experimenter occupying an adjacent room. The video monitor was located on a table about one meter in front of the subject and at eye level; a keyboard rested in his/her lap.

The testing session comprised 80 trials or Ahands@ of the computerized, video-gambling task, which subjects initiated at their own pace by use of the space key on the keyboard. On each hand, subjects were shown four Acards@ on a computer monitor. Two and one-half seconds following presentation of the last of four card images, all four cards were displayed on screen together. The subjects then selected one of the cards using the left/right arrow key to move a cursor on the

[1] Random numbers between 1 and 4 were generated by the RRANGE function included in the MEL software (version 1.0), seeded by the pulse count of the system timer. A frequency test on 1000 numbers (between 1 and 4) generated by this function did not indicate significant deviations from randomness, $c^2 = 0.296$, *d.f.* = 3, n.s. The serial dependency of the algorithm=s output was not tested. However, other calls to this function were intersperced between target selections, i.e., calls to randomly select the next pack of cards to be used and to randomize the presentation order of the cards within the pack. Therefore, it seems extremely unlikely that a serial dependency of the random function=s output, even if it existed, could be detected by the subjects.

screen and registered their guess using the enter key.[2] The Awinning card" was then displayed on the monitor as feedback. The subject's ERPs to the display of each card, including the target and three decoys were recorded from an array of scalp sites.

There were 40 such hands for each of two conditions, giving the player that many chances to win or lose. In one condition, each subject played a just-for-fun (no-wager) game; while in the second, the player wagered money (50 cents/hand; each with a $2 possible payoff, with a maximum possible payoff/session of $80). Subjects, initially given a betting "kitty" of $10 dollars, could lose no more than $10 dollars.

In alternating fashion, blocks of 20 hands were conducted with wagering, alternating with blocks of 20 hands with no wagering. Subjects were also counterbalanced to perform the experiment either starting in the wager condition or the nonwager condition. Each wager was 50 cents; therefore, on each hand in a wager block, 50 cents was subtracted from the kitty. For those (wager) hands on which the subject correctly guessed the target, $2 was added to the kitty. On average, subjects could be expected to have $10 remaining in their kitty at the end of the session. After every run, a performance summary and the amount of money remaining in their kitty was displayed to the subject on the monitor (target feedback was also presented after each hand). Performance data were output onto a signal channel, recorded on the chart paper of a polygraph, as well as being digitized online, along with brainwave data, and stored on a computers hard disk.

## EEG Recording and Data Reduction

The EEG was recorded continuously while the subjects were performing the video gambling task. Signal pulses on the signal channel permitted later, off-line extraction of EEG epochs associated with delivery of the playing card stimuli. Electrodes were applied over the 19 International 10-20 scalp electrode sites and a forehead ground, using an electrode cap and conducting gel made by Electro-Cap International, Inc.; however, only 12 of these sites were presently analyzed. Scalp leads were referenced to the left mastoid. The right mastoid, referred to the left mastoid, was recorded on a separate channel for purposes of later digital linking. Impedances for scalp, ground, and reference electrodes were kept below 5 k ohms. In addition, the impedances at the left and right mastoid leads were balanced (equalized). An electrode placed below the right eye, in conjunction with the Fp1 lead located directly above the right eye, was used to monitor eye blinks and movements. The physiological signals were amplified with custom-built Midwest Research Associates DC amplifiers having automatic DC reset capability and a **2** high frequency roll-off at 50 Hz and were digitized on-line at 256 samples per second.

[2] Because the screen display requiring a keyboard response occurs more than two seconds following delivery of the last of the four card stimuli, the ERPs elicited by those cards, which are analyzed here, are not affected by any motor artifact that may be associated with the key press response.

Data editing was performed off-line and was blind to stimulus category, i.e., target or decoy. EEG epochs containing eye or movement artifacts in any of the four stimulus epochs, or instances where the voltage on any EEG channel exceeded 60 μV, from 100 ms pre-stimulus to 600 ms post-stimulus, were excluded from analysis by a computer-based, automated editing system developed in our lab.

For each subject, averaged ERPs were formed by calculating the mean of all artifact-free EEG epochs at each time point in the target and nontarget category in order to enhance the underlying electrical brain waveform. The average ERP waveform at each site was digitally linked by subtracting **2** of the voltage of the right mastoid. The Negative Slow Wave (NSW) was measured as the integrated amplitude of the ERP waveforms in the latency range 150-500 ms, post-stimulus, relative to the mean amplitude of a 100 ms pre-stimulus baseline. ERP analyses compared the NSW elicited by targets and nontargets, regardless of guessing accuracy, from 12 scalp sites (F7, F3, F4, F8, T3, C3, C4, T4, T5, P3, P4, T6) during the nonwager condition. The nontargets used in this analysis were selected from among the three decoys by a random process without respect to the results of artifact editing.[3] If either the target or the nontarget contained artifact, the entire hand was excluded from analysis.

Grand averages (across all 20 subjects) of the target and nontarget ERPs are shown in Figure 1 (note the convention of displaying negative-going voltages in the upward direction). All 12 recording sites were averaged together in Figure 1a. The morphology and amplitudes of the peaks and valleys are consistent with those usually found for visual ERPs in cognitive tasks and with our previous data (See Don et. al 1995). The most conspicuous difference between target and nontarget averages is the negative displacement of the target curve relative to the nontarget curve throughout much of the epoch, especially over the right hemisphere sites (Figure 1c).

## RESULTS

### Performance

Guessing accuracy in the gambling task did not deviate significantly from mean chance expectation (MCE). Collectively, the subjects correctly guessed 204 (27%) targets out of 755 nonwager hands, whereas about 189 correct guesses (25%) would have been expected by chance ($p > .10$,

[3] The output of the RAND function from Microsoft C/C++ version 7.0 was scaled to give an integer between 1 and 4. If that number was the same as the target, a new random number was generated. RAND was seeded using the TIME function which gives the number of seconds elapsed since midnight (00:00:00), December 31st, 1899.

two-tailed exact binomial).[4] Guessing accuracy was on wager hands was exactly at MCE;

[4] Because of equipment malfunction, 6 (out of 20) subjects did not receive exactly 40 nonwager hands; therefore, the numbers of such hands is less than the planned 800 (20 subjects x 40 hands/subject).

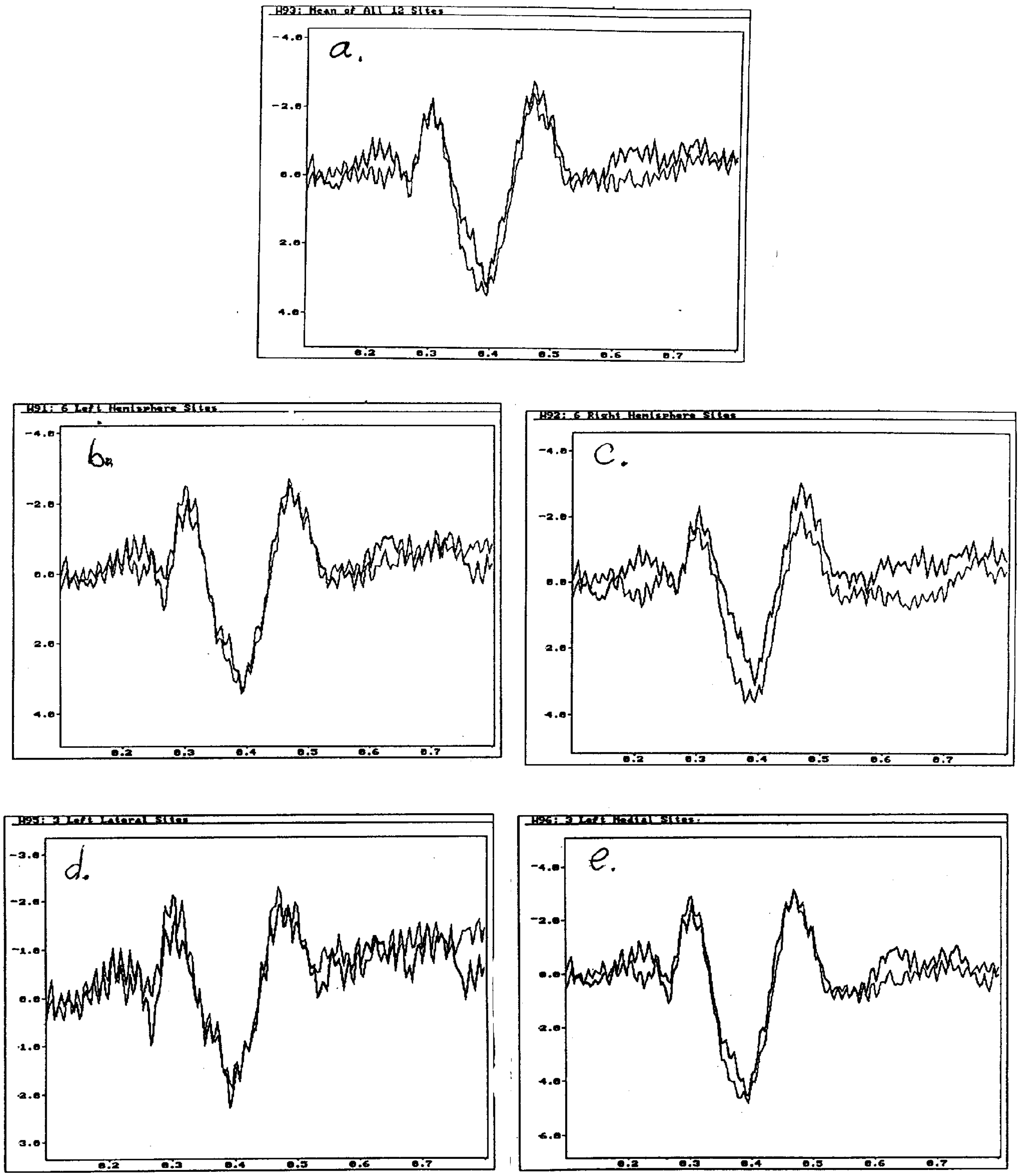


Figure 1. Grand averaged ERPs to targets (thick tracings) and nontargets (thin tracings) averaged across 20 subjects. Labels on the x-axis indicate time in sec from the start of the epoch. Stimulus onset is at "0.2" sec. The NSW (150-500 ms post-stimulus onset) is from 0.35 to 0.7 sec on x-axis. Negative voltages (in µV) plotted in upward direction (a: all sites; b: left hemisphere; c: right hemisphere; d: left lateral; e: left medial).

with subjects correctly guessing 200 targets (25%) out of 800 wager trials (p > .10, two-tailed exact binomial).

*ERPs on Nonwager Hands*

The NSW amplitude measured at 12 recording sites (F3, F4, C3, C4. P3, P4, F7, F8, T3, T4, T5 and T6) was analyzed in a 4-factor, repeated-measures Analysis of Variance (ANOVA) analysis with three topographic factors, Hemisphere (left, right) x Lateral-Medial x Anterior-Posterior (frontal, central, parietal), and the Stimulus-Category factor (target, nontarget).[5] Only main or interaction effects involving the Stimulus-Category factor, i.e., those relevant to the psi hypothesis, are reported here. The level of significance was set at $\alpha = .05$, one-tailed, because the prediction was directional, i.e., greater negative (or less positive) amplitude for targets than for nontargets. Main effects of the three topographic factors (Hemisphere, Lateral-Medial, Anterior-Posterior), and interactions between these factors, are not presented or discussed since they had no psi relevance.

The main effect of Stimulus Category on NSW amplitude fell just short of statistical significance, F(1/19) = 2.20, p < .08, one-tailed. However, the tendency was in the predicted direction, i.e., a greater negative (or less positive) NSW amplitude following target stimuli (-0.12 uV) than following nontarget stimuli (0.38 uV). See figure 1a. In addition, the Stimulus Category x Hemisphere interaction was significant, F(1/19) = 6.30, *p* = .01, one-tailed. The effect size (*f* ) of this Stimulus Category x Hemisphere interaction effect on NSW amplitude was calculated as *f* = the square root of the quantity (*df* x F/N) = .56, where *df* = the degrees of freedom of the term in the numerator, or 1 in this example, *F* = the value of the F-ratio, and *N* = the sample size. Cohen (1988) has categorized .1 as a small effect, .25 as a medium effect, and .4 as a large effect.

Simple-effects follow-up tests performed at each hemisphere indicated an enhanced NSW for targets (-0.21 uV) than for nontargets (0.64 uV) over the six right hemisphere sites, F(1/19) = 6.80, *p* < .01. See figure 1c. At the six left hemisphere sites (figure 1b), the overall difference in NSW amplitude between targets (-0.04 uV) and nontargets (0.12 uV) was nonsignificant, F(1/19) = 0.15, n.s. However, a Stimulus Category x Lateral-Medial Interaction was significant in this simple-effects test at the left hemisphere sites, F(1/19) = 3.52, *p* < .04, one-tailed, indicating that

[5] ERP data were assessed using ANOVA instead of multivariate analysis of variance (MANOVA) because statistical power is unacceptably low for MANOVA with small numbers of subjects (Vasey & Thayer, 1987). To protect against nonsphericity, we used ε-adjusted p-values (Greenhouse-Geisser) for all subtests involving factors having more than two levels.

the NSW amplitude was enhanced for targets relative to nontargets at the left medial sites (F3, C3, P3) but not at the left lateral sites (F7, T3, T5). See figures 1e and 1d, respectively.

*ERPs on Wager Hands*

A post hoc, analysis of ERP data collected during the wager condition was nonsignificant. A 4-factor, repeated measures ANOVA, analogous to the above, indicated a nonsignificant main effect of Stimulus-Category, $F(1/19) = 0.10$, $p > .10$, two-tailed, and nonsignificant (2,3, and 4-way) interactions between the Stimulus-Category factor and the three topographic factors, all $p > .10$, two-tailed.

## DISCUSSION

This is the fourth time we have observed an enhanced NSW in the ERPs elicited by targets relative to that elicited by nontargets in a forced-choice psi task. Although the presently observed right-hemispheric dominance of the NSW effect was unexpected based on our previous results, the similarities to those earlier data in the waveshape, amplitude, polarity, and latency of the effect convinces us that we are seeing essentially the same ERP phenomenon as in the previous three studies. As before (Warren et. al 1992a; 1992b; Don et. al 1995), we may interpret the results in terms of unconscious or preconscious psi. Guessing accuracy did not deviate significantly from chance, and yet ERPs elicited by target and nontarget stimuli were significantly different. Thus, although conscious guessing behavior was not influenced significantly by the psi information, differential brain responses to target and nontarget stimuli indicated a recognition at some level that these stimuli belonged to different categories.

In addition, we have recently come across a previously published report of an ERP study on Pavlovian conditioning which provides further independent support for the findings (Paige, Newton, Reese & Dykman, 1987). The results of the Paige et al. study, which was conducted by non-psi investigators for non-psi purposes, were entirely consistent with the findings from our own laboratory. Those investigators observed a significant ERP difference between two tones in the habituation phase of a conditioning experiment, before subjects had any way of knowing which of the two stimuli would subsequently be reinforced. The ERP effect observed by those investigators bears a remarkable resemblance to our own findings. The target, i.e., the subsequently-reinforced tone, elicited a brain potential which appears more negative in the approximate 100-500 ms latency range than the ERP elicited by the nontarget, i.e., the nonreinforced tone. The authors of that report admitted to being perplexed by this unexpected finding, but apparently unwilling to entertain the psi hypothesis, they ascribed it to a Type I error.

By definition, we have regarded the differential brain response elicited by the targets relative to the nontargets as an indicator of unconscious, or preconscious, psi because it did not result in significant, overt, guessing performance. Another reason for regarding the negative displacement we observed as reflecting an unconscious brain process is that a fully conscious recognition of the target stimuli would be expected to elicit a P300 component (a positive-going ERP typically observed at about 300 ms or later; for review, see Pritchard, 1981) instead of the slow negative shift observed in our paradigm.

The NSW appears similar to an ERP component known as “processing negativity” in the cognitive ERP literature (e.g., Näätänen and Michie, 1979). Broadly put, processing negativities are associated with relatively long-duration attentional processes, beginning as early as 50 ms post-stimulus onset and commonly extending for several hundred milliseconds thereafter. Processing negativities are typically observed in selective attention experiments and measured as a difference waveform obtained by subtracting the ERPs elicited by stimuli delivered in a non-attended channel from those elicited by stimuli delivered in an attended channel. However, the question of whether the negative displacement observed here is one and the same thing as the processing negativity in the ERP literature cannot be answered definitively because our experimental situation was very different from the standard selective attention paradigm in that we did not define an attended channel on the basis of discriminable sensory attributes.

The variability in the topographic distribution of the ERP effect among the four studies calls for some explanation. In Study 1 and Study 3, the ERP effects were bilaterally symmetric, in Study 2, the effect appeared mainly over the left hemisphere, whereas presently, the effect appears larger over the right hemisphere. Unfortunately, at this stage of our investigations we cannot definitively point to any factor which might be responsible for these apparent discrepancies, but we offer the following possibilities. First, there were important differences in subject populations among studies; the first two studies were conducted using a single, exceptional psi subject, whereas the third and fourth (present) studies used a group of subjects unselected for psi, but selected for interest and involvement in gambling. Even between the third and fourth studies there was a difference in subject populations in that the present, fourth study used a group of subjects who had greater gambling pathology, on average, than the subjects participating in the third study. Another possibility is that the topographic variability among studies may have been due to differences in the EEG references among studies. The first three studies were conducted using the physically-linked ear reference following a decades-long standard practice in ERP research, whereas the present study used the more recent ERP procedure of recording with a single-sided reference and then algebraically computing ERPs to Adigitally-linked@ ears. Because this newer reference was only recently adopted by this lab, we have little experience using it and we=re not certain of its effects on our recordings The purpose of using the newer procedure is to have the ability to later calculate reference-free Laplacian, or current source density waveforms, which have the advantage of much greater spatial resolution. However, the Laplacian transform is computationally intensive and we haven=t had time to do it for this paper. Moreover, to help determine whether or not the reference was responsible for the present hemispheric asymmetry, we intend to record the next group of subjects using a right mastoid reference, and then digitally-linking to the left mastoid, a procedure which should flip the asymmetry if it was due to the reference.

The fact that subjects who participated in the last two experiments of this series were unselected for variables known to be related to psi performance, such as interest or belief in psi, or demonstrable psi ability, but were selected for interest in gambling, bears on the issue of the generalizability of the results. Our first two studies were conducted using a single subject selected for his psi abilities, but who was also known to be a horse racing fan. Our third study used subjects who reported gambling at least once a week, as did the subjects who participated in the present study. Therefore, it is not known how, or if, this selection criterion may have affected the results, and thus whether the results might also generalize to non-gamblers. In this regard, even though the NSW effect observed presently, and in the previous sample of gamblers (Study 3), was significant only for the nonwager condition, it is not known whether these results may have been affected by the contrast with alternating blocks of wager hands.

Future efforts from this laboratory should aimed at elucidating the mechanisms underlying the phenomenon and/or exploring its relationship to other variables. For example, recent studies of electrodermal activity (EDA) preceding the delivery of emotional stimuli indicates a precognitive reactivity to future events by the autonomic nervous system similar to the present ERP index of brain function (e.g., Radin, 1996). Moreover, Bierman & Radin (1998), in a re-analysis of EDA data from a gambling study published by Bechara et al., 1997, showed that this precognitive EDA response, which they termed Apresentiment,@ may be influenced by future outcomes in a gambling task. Therefore, it would seem worthwhile to examine whether there exists a relationship between the brain ERP and the EDA elicited by the same stimuli in a gambling task. Future worthwhile study might also examine the utility of single-trial ERP (and EDA) data entered in a neural network for classifying targets and nontargets. The potential ability to predict gambling event outcomes would have obvious practical application. Indeed, Warren et al. (1992a) reported promising results in a preliminary exploration of this question using discriminant functions analysis to classify single-trial ERPs to targets and nontargets in a non-gambling psi task.

## REFERENCES


Bechara, A., Damasio, H., Tranel, D., & Damasio, A. R. (1997). Deciding advantageously before knowing the advantageous strategy. Science, 275, 1293-1294.

Bierman, D., & Radin, D. (1998). Non conscious processes and intuition: Is there an anomalous component? Paper presented at the Toward a Science of Consciousness 1998 ATucson III@ conference, April 27 - May 2, 1998, Tucson, AZ.

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Don, N. S., McDonough, B.E., & Warren, C. A., (1995). Differential brain responses to targets and nontargets in a precognitive forced-choice task. Proceedings of Presented Papers, the 38th Annual Parapsychological Association Convention, Durham, NC.

Donchin, E., Ritter, W., & McCallum, W.C. (1978). Cognitive psychophysiology: The endogenous components of the ERP. In E. Callaway, P. Tueting & S.H. Koslow (Eds.), Event Related Brain Potentials in Man, New York: Academic Press.

Näätänen, R., & Michie, P. (1979). Early selective-attention effects on the evoked potential: A critical review and reinterpretation. Biological Psychology, 8, 81-136.

Paige, S.R., Newton, J.E.O., Reese, W.G., & Dykman, R.A. (1987). Pavlovian conditioning of cortical event-related potentials. In R. Johnson, Jr., J.W. Rohrbaugh & R. Parasuraman (Eds.) Current Trends in Event-Related Potential Research, EEG Suppl. 40, Amsterdam: Elsevier, 355-359.

Pritchard, W.S. (1981). Psychophysiology of P300. Psychological Bulletin, 89, 506-540.

Psychophysical Research Laboratories (1985). Psilab II User's Manual, Princeton, NJ: Psychophysical Research Laboratories.

Radin, D. I. (1996). Unconscious perception of future emotions: An experiment in presentiment. In E. C. May (Ed.) The Parapsychological Association 39th Annual Convention: Proceedings of Presented Papers.

Vasey, M. W., & Thayer, J. F. (1987). The continuing problem of false positives in repeated measures ANOVA in psychophysiology: A multivariate solution. Psychophysiology, 24, 479-486.

Warren, C. A., McDonough, B.E., & Don, N. S. (1992a). Event-related brain potential changes in a psi task. Journal of Parapsychology, 56, 1-30.

Warren, C. A., McDonough, B.E., & Don, N. S. (1992b). Partial replication of single subject event-related potential effects in a psi task. In E. Cook (Ed.) The Parapsychological Association 35th Annual Convention: Proceedings of Presented Papers.

Warren, C.A. & McDonough, B. E. (1995). Positive event-related potentials to real and dummy rule-learning feedback and to perceptuomotor feedback. Electroencephalography and Clinical Neurophysiology, 94, 60-79.

Warren, C.A., Don, N.S., & McDonough, B.E. (1997). A40 Hz@ EEG and attention to psi information. In R. Wiseman (Ed.) The Parapsychological Association 40th Annual Convention: Proceedings of Presented Papers.

# THE CORRELATION OF THE GRADIENT OF SHANNON ENTROPY AND ANOMALOUS COGNITION: TOWARDS AN AC SENSORY SYSTEM

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## ABSTRACT

Lantz et al. (1994) conducted two high-quality experiments a year apart that demonstrated strong evidence for anomalous cognition (AC). May, Spottiswoode, and James (1994a) analyzed these data and compared the Shannon entropy and its gradient for the targets used in the studies with the AC performance. Overall, they found a significant correlation between the quality of the AC with the gradient, but not with the entropy itself. May et al. speculated that this result was suggestive of the behavior of the other sensory systems. In this study, we created a new target pool and a more sensitive analytical system in order to replicate these earlier findings. We invited five experienced receivers (i.e., experiment participants) to contribute 15 trials each. The target pool consisted of 300 carefully chosen digital images from a set of 20,000 pictures from the Corel Stock Photo Library of Professional Photographs. The trial protocol was controlled by email and feedback was provided on the World Wide Web. All experimenters, as well as the receiver, were blind to the target choice in a trial until the analysis was complete. Besides the usual rank-order analysis, two additional methods were used to assess the quality of the AC. The first of these was a zero-to-seven rating scale that had been used in the earlier studies. The second, a figure of merit, was based upon a fuzzy-set encoding of the targets and responses. The primary hypotheses were that a significant correlation would be seen between the figure of merit quality assessment and the gradient of Shannon entropy for the associated target, and that the correlation using the rating assessment would be consistent with earlier findings. A secondary hypothesis was that the figure of merit quality would not correlate with the entropy of the associated target. All hypotheses were confirmed. The correlation of the figure of merit with the entropic gradient was significant (Spearman's $r = 0.212$, $df = 73$, $p = 0.034$). The Spearman's $r$ for the correlation with the entropy was 0.042, $df = 73$, $p = 0.361$. The combined correlation using the rating assessment for the static targets in the previous studies led to a Spearman's $r = 0.161$, $df = 41$, $p = 0.152$; whereas in this study $r = 0.183$, $df = 24$, $p = 0.188$. We discuss the reasons why the entropy correlation with the figure of merit is significant whereas the sum-of-rank statistic is not (i.e. mean rank = 2.987, ES = 0.004, and $p = 0.486$.

## INTRODUCTION

Lantz et al. (1994) reported on two experiments, the first of which was conducted in 1992, to test sender condition and target type in an anomalous cognition (AC) experiment. The hypotheses in these studies addressed whether a sender is necessary for AC information transfer and whether AC performance differs when the targets are static photographs or dynamic material, such as videos.

Lantz et al. found that a sender is not a necessary component in a successful AC experiment, and that the data supported, but not significantly so, a target-type preference in favor of static material. Because there were no significant interactions in a $2 \times 2$ analysis of variance (ANOVA), the data were combined across the sender/no-sender condition. Blind ranking achieved a sum-of-ranks for the static targets of 265, where the chance expectation was 300, leading to an effect size of 0.248 and $p = 0.007$. The analysis of the 100-trial dynamic targets led to a sum-of-ranks of 300, an effect size of 0.000, and $p = 0.500$.

A second experiment was conducted a year later but was also reported in Lantz et al. (1994). In that study, a sender was not used and the protocol differed considerably from the first experiment. Four participants contributed a total of 45 trials in each to two target-type conditions leading to a combined effect size of 0.550 for the static targets and the same value for the dynamic ones.

Lantz et al. (1994) discussed the apparent contradiction of the results of their two studies. They speculated that the static target were better in their first study because of a lack of content parity between the static and dynamic targets. However, this does not explain the lack of a difference between static and dynamic targets in their second study. In addition, their results are inconsistent with those of some of the ganzfeld research regarding static versus dynamic targets. Bem and Honorton (1994) found that dynamic targets produced better results in the ganzfeld than did static targets.

The data from both of Lantz et al. studies were analyzed to investigate whether AC performance depended on the gradient of Shannon entropy of the targets (May, Spottiswoode, and James, 1994a). This idea arose from our laboratory's anecdotal evidence that AC functioned particularly well when targets were especially dynamic. That is, when targets involved large changes of energy/entropy such as underground nuclear explosions, particle accelerators, or rocket launches. In several instances AC was outstanding when targets underwent massive changes in energy or entropy in a very short period of time during the session. Bem and Honorton's (1994) finding is also suggestive that an entropic change in the target might lead to better results. As a possible explanation of these observations, consider that AC may be mediated through a specialized sensorial system, and that this system might behave similarly to the five known sensorial systems. We might then reasonably expect that AC would correlate positively with the changes of the sensor-input signal and not correlate as well with the level of the sensor-input signal itself. In vision, for example, the system is very sensitive to changes in brightness across the field, but relatively insensitive to the absolute level of illumination. Analogously, we hypothesized that the AC system might be sensitive to changes in the level of information content across a target, but insensitive to the absolute level of that measure.

In the first experiment, May et al. (1994a) found a significant correlation between the gradient of the Shannon entropy of the target and the quality of AC (Spearman rank-order correlation coefficient, $r$, of $0.452$, $df = 26$, $t = 2.58$, $p = 7.0 \times 10^{-3}$) for static photographic targets. Unfortunately, with dynamic targets, there was little evidence of AC and a resulting small correlation with the gradient of the entropy. In the second experiment, they found strong evidence for AC in both static and dynamic targets and for the two target types combined the correlation between AC performance and entropy gradient $r$ was $0.337$, $df = 31$, $t = 1.99$, $p =$

*0.028*. As predicted, the correlation with the entropy itself was considerably smaller ($r = 0.234$, $t = 1.34$, $df = 31$, $p = 0.095$). The correlation for the combined static targets from both studies was $r = 0.161$, $df = 41$, $p = 0.152$. Because of the different target systems and protocols in these studies, the results remain somewhat ambiguous. This report provides a detailed description of an experiment to replicate May, Spottiswoode, and James' (1994a) entropy findings.

## Hypotheses

The primary hypotheses were:

- That a significant correlation exists between the quality of AC, as measured by a fuzzy set technique, and the gradient of Shannon entropy of its associated target.
- The correlation of the gradient with the quality of AC as measured by the upper half of the rating scale shown below in Figure 2 will be consistent with the static target correlation seen in the earlier experiments (May, et al. 1994a).

The concept of fuzzy sets was first applied to the analysis of AC data by May et al (1990). A fuzzy set definition of a target is similar to the commonly used descriptor lists in which an analyst is asked to ascribe the presence or absence of each element in a list of items. Instead of a forced yes/no to the presence of an element, such as water, a fuzzy approach allows for a quantitative coding of a subjective impression. For example, water might be 30% visually impacting in a target, so it is coded as 0.3 rather than either one or zero. A response is coded in a similar way.

Three quantities are defined from the fuzzy set representation of a target and a response. The *accuracy* is defined as the percent of the target that was described correctly; the *reliability* is defined as the percent of the response that was correct; and, *the figure of merit* is defined as the product of the two. Because the fuzzy set measure is less granular than a rating measure, being a rational rather than an ordinal scale, we chose it as the primary measure. The rating scale correlation was included as an historical link to our earlier experiments. A more detailed description of the technique can be found in the AC Data Analysis Section, below.
We also hypothesized that the correlation of the figure of merit with the total entropy of the target would be much less than the correlation with the gradient of the entropy.

## EXPERIMENT PROTOCOL

In contrast with the majority of our earlier AC studies, we designed a protocol in which the receivers were physically located from five to 4,500 km distant from the laboratory. In addition, many aspects of the experiment were handled automatically by two separate computers.

### Target Pool Construction

For this experiment we developed a completely new target pool based exclusively upon the Corel Stock Photo Library of Professional Photographs. This library of copyright-free images is provided in digital form and comprises 100 images on each of 200 CD-ROM's. Each image is approximately 18 MB in size, which corresponds to a landscape format picture of $3200 \times 1875$ pixels in 24-bit color. Corel also publishes a booklet of thumbnail images of the complete set.

#### *Selection Criteria*

The first stage in constructing the target pool consisted of creating a design specification of the type of photographs that would qualify as a potential AC target. Based upon earlier experience (May, Utts, Humphrey, Luke, and Trask, 1990) we adopted the following guidelines:

The photographs must have the following general properties.

- Thematic Coherence. Each photograph should be a real scene as opposed to a collage and where possible should possess elements that could be easily sketched.
- Size Homogeneity. The photographs would not contain any surprises with regard to size. For example, there would not be a photograph of a brick and another of a mountain range.
- Pool Coherence. All the photographs would consist of only outside scenes.

The following elements would not be included in the pool by construction or by photographic editing:

- People
- Transportation Devices (e.g., boats, cars, etc.)
- Small Human Artifacts (e.g., tools, toys, etc.)

We would make every effort to remove these kinds of items; however, they may be present in some photographs. If so, they would be very difficult to see and in all cases would be insignificant relative to the rest of the scene.

Finally, we would not allow:

- Odd camera angles or unusual or distorted perspectives
- Odd or unusual lighting conditions.

Aside than the above restrictions, the target pool photographs could show any scene, anywhere.

Following these guidelines, we rejected approximately half the original set of 20,000 photographs by visual inspection of the thumbnail images.

Our long-standing earlier target pool consisted of 100 photographs divided into 20 packets of five dissimilar images each. In that pool, a target for a trial was determined by first choosing a random integer between one and 20 to select a packet and then choosing a random integer between one and five to select a target. The remaining four targets within the selected pack then served as decoys for a blind analytical assessment by rank ordering.

For the development of this new pool, we chose a different approach. Namely, the analysis decoy target images would be determined after the AC trial was complete. To assure that we could do this in a blind and algorithmic fashion, we adopted a hierarchical design of Groups, Categories, and Images. A Group consisted of five Categories and each Category contained five images. In this case, however, the images within a Category would be as much alike each other as possible, though they must be of different scenes. Differing perspectives of the same scene were not included. Thus, a single Category of "waterfalls," for example, would contain five similar, but different, waterfalls. In contrast we made every attempt to choose Categories within a Group to be as different from one another as possible, to make them orthogonal in other words. For example we would not have a "River" category in the same Group as a "Waterfall" category. The number of different Groups was determined by the remaining 10,000 images that survived the first cut.

| **Group ID** | **Category** | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 1 | Bridges | Canyons | Cities | Structures | Waterfalls |
| 2 | Bridges | Cities | Fields | Mountains | Structures |
| 3 | Bridges | Lakes | Mountains | Structures | Towns |
| 4 | Bridges | Mosques | Mountains | Roads | Waterfalls |
| 5 | Bridges | Churches | Deserts | Mountains | Pyramids |
| 6 | Fields | Islands | Roads | Ruins | Waterfalls |
| 7 | Cities | Coasts | Deserts | Waterfalls | Windmills |
| 8 | Coasts | Fields | Lighthouses | Mountains | Rivers |
| 9 | Buildings | Coasts | Pyramids | Vineyards | Waterfalls |
| 10 | Buildings | Coasts | Fences | Lakes | Rocks |
| 11 | Fields | Structures | Rivers | Ruins | Streets |
| 12 | Coasts | Mountains | Roads | ruins | Towns |

*All Structures in the table represent Oriental Structures

**Table 1:** Categories for Each Target Group

Two laboratory personnel examined all 10,000 images on a high-resolution computer display and approximately 800 candidate photographs met the above acceptance criteria. After some digital editing, we identified from this set of 800 photographs, 12 Groups of 25 images for a total of 300 targets. Table 1 shows the Categories that were identified for each of the 12 target Groups. No attempt was made to force the Categories to be orthogonal across Groups.

Figure 1 shows an example of the digital editing of an image that was not selected as part of the pool to illustrate the capability to modify an image to conform to the construction guidelines. In the temple scene, nearly all the people were removed by making reasonable guesses as to what the image would have been behind each individual. As the final step in preparing an image for the target pool, the picture was cropped if necessary, and resized to 800 by 600 pixels, each having 24 bits of color information.

*Fuzzy Set Encoding*

To facilitate subsequent computer analysis of AC trials the images were encoded using a system of descriptive elements. Each element was assigned a fuzzy set membership value for each image. We created a universal set of elements (USE), comprising 50 elements, which we selected from the original set of 131 elements used in our earlier work (May, Utts, Humphrey, Luke, and Trask, 1990). We also added elements for features that were unique to this particular set of photographs. Six individuals each coded all 300 images against this USE. As in earlier work, the coding criterion was the degree to which each element was visually impacting to the general scene. The range of visual impact ran from zero to one in steps of 0.1. For example, in the bottom image in Figure 1 we might code 0.6 for *buildings* and 0.3 for *repeat motif*.

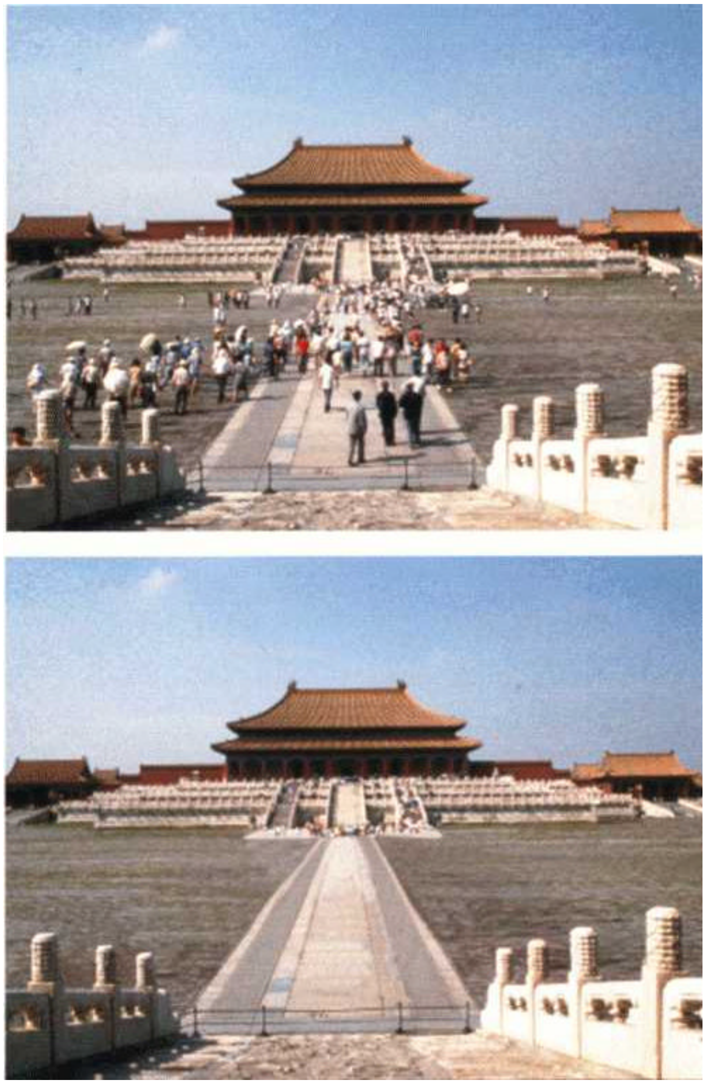

**Figure 1:** An Example of Digital Editing

The principal investigator selected 24 elements out of the 50 and qualitatively condensed the scorings from the six coders to a single "consensus" fuzzy set representation of the targets. These 24 elements were selected on the basis of extensive experience as well as upon the formal analysis of a single study. The principal criterion used in the selection was that the elements should not be too "low-level" such as *lines* and *geometric shapes*, nor should they be too "high-level" such as *office building*. These 24 were an attempt to strike a compromise between these two extremes. Table 2 shows the 24 elements that comprised the final fuzzy set USE.[*]

Universal Set of Elements

[*] A detailed description of the target pool construction and its associated fuzzy set encoding is currently being considered as a separate paper.

| | | |
|---|---|---|
| Buildings | Coliseums | Glaciers/Ice/Snow |
| Villages/Towns/Cities | Hills/Cliffs/Valleys | Vegetation |
| Ruins | Mountains | Deserts |
| Roads | Land/Water Interface | Natural |
| Pyramids | Lakes/Ponds | Manmade |
| Windmills | Rivers/Streams | Prominent/Central |
| Lighthouses | Coastlines | Textured |
| Bridges | Waterfalls | Repeat Motif |

**Table 2:** Universal Set of Elements

### Receiver Selection

Five experienced receivers participated in this experiment. They were chosen on the basis of their availability, their willingness to participate in a lengthy AC study, and especially upon their previous and sustained good performance.

### Number of Trials

The total number of trials for this study was 75 (i.e. 15 for each receiver) and was determined, in advance, by receivers' availability and statistical power considerations. We used the average effect size of 0.550 from a previous similar experiment (Lantz, et al., 1994) to compute a statistical power of 68% to reach significance (i.e., $p = 0.05$) for a single receiver and a power of 99% to reach a significant study.

### Trial Protocol

Let experimenter one and experimenter two be designated E1 and E2, respectively. E1 was located in the laboratory in Palo Alto, California while E2 was located in a laboratory in Los Angeles, California. The complete target pool was independently installed on E1 and E2's computers. Note that all communication between E1 and E2 occurred only by email. At a pre-arranged scheduled time the following events took place in the order shown:

- E1 requested that E2 generate a target for the up-coming trial.
- E2 invoked a computer program that first randomly selected one of the 12 Groups, then randomly selected one of the five available Categories in that Group and finally randomly selected a target image from within that Category of five images. The program saved its choice to a binary file and did not notify E2 about any aspect of the selection.
- E2 notified E1 that the selection process was complete.
- E1 telephoned the scheduled receiver and acted as a monitor for an AC session lasting from five to 15 minutes. The receiver drew and wrote the impressions and faxed them to E1 at the end of the session.
- E1 requested that E2 generate a decoy set. E2 invoked a second computer program that read the binary file containing the target information and randomly selected a target image from each of the four remaining Categories from within the selected Group. The four decoy target numbers and the intended target number were randomly ordered and then automatically

emailed to E1.

- E1 analyzed the session and emailed the results to E2. At this point in time nobody was yet aware of the selected target, and the analysis was complete before the receiver obtained feedback.
- E2 invoked a third program that read the original binary file emailed the actual target number to E1.
- E1 posted the target photograph on a web site to which only the receiver had access, and then telephoned the receiver to provide verbal feedback and to prompt the receiver to access the web site for visual feedback.

All transactions were logged and session and analysis details were automatically stored in a database. Typically such a trial would be complete in 30-60 minutes. Furthermore, in contrast to our earlier studies the analysis was completed on each trial before anyone was aware of the intended target.

## AC Data Analysis

We had decided to perform three separate analyses on the AC data. The first of these was a standard rank-ordering of the target pack, which consisted of four decoys and the intended target. E1 was presented with the words and drawings along with the target pack associated with the trial and the task was to rank-order the targets from the best to the worst match to the response. After all $N$ trials were analyzed for a single receiver, a continuity-corrected effect size was computed as:

$$ES = \frac{\left(3 - R_{ave} - 0.5 / N\right)}{\sqrt{2}},$$

where $R_{ave}$ is the average rank over the $N$ trials, and the last term in the numerator is a continuity correction for small $N$. The $z$-score associated with this effect size is given by:

$$z = ES \times \sqrt{N}.$$

The rank-order analysis was designated, in advance, as the primary indicator of AC in the study.

Because, the primary goal of the experiment was to explore the relationship between the gradient of Shannon entropy and the quality of the remote viewing, we performed two additional analyses. Lantz et al. (1994) showed that assessing AC performance by rank ordering was not optimal for correlation studies for two reasons. Firstly, the rank number is strongly dependent upon the degree to which the photographs in the analysis pack are different from one another. Secondly, the ranking method discards information about the absolute quality of the match; it only describes the relative closeness of the match in comparison to the decoys. Consequently a perfect match between a response and a target would be assigned the same first place rank as a response that corresponded far less closely but was, however, sufficient to allow the analyst to assign a first palace match given the decoy targets.

For historical reasons and for comparison with earlier entropy experiments we used a very slightly modified version of the zero to seven rating scale. Figure 2 shows a screen capture image of the scale that was presented to E1 during the analysis.
To be assigned a given assessment value, the correspondence between target and response must

meet one of the criteria shown in Figure 2. As before (May, Spottiswoode, and James, 1994a), the scale was divided into two sections; an assessment of four and above indicating possible AC contact with the target and three and below not.

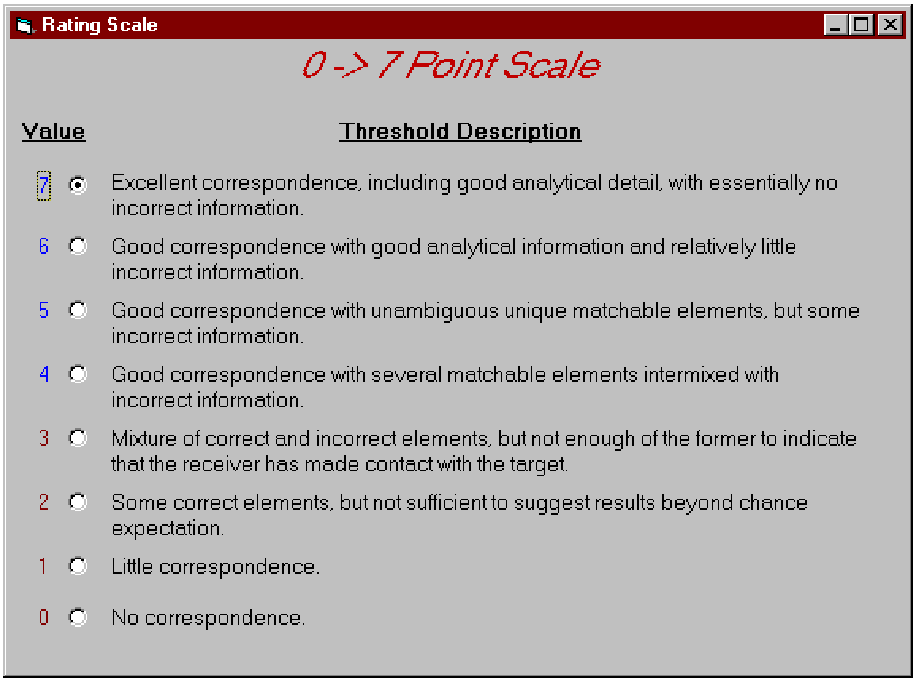


**Figure2:** Zero to Seven Assessment Scale

We had recognized a number of difficulties with the rating scale. The assessment values are granular, that is they are integers with no possibility of values in between. More importantly, the scale does not account for the amount of material in the response. For example, the response could be simply the word “city” and receive a value of seven for the match to a city target even though there might be many elements, such as a river, a bridge, and mountain background, in addition to the city in the target.

Because of its extensive previous use, this rating scale was included in the analysis but defined only as a secondary measure to be used in the entropy correlation analysis. The primary measure of the absolute correspondence of a response to its intended target was the fuzzy-set based figure of merit; whereas the rank-order statistic was used as the primary measure for overall AC.

May et al. (1990) provided a partial solution to the problem associated with the rating scale through the use of fuzzy sets. We used a fuzzy set measure for an assessment of the degree of correspondence between a response and a target. We defined the figure of merit (FM) as the *accuracy* times the *reliability*. The accuracy is the percentage of the target image elements that were described correctly, and reliability is the percentage of the response elements that were correct. While neither the accuracy nor reliability alone is a sufficient measure of AC, the product of the two is. Formally, the accuracy is defined by:

$$accuracy = \frac{\sum_{j=1}^{N} \min(T_j, R_j)}{\sum_{j=1}^{N} T_j}, \qquad (0 \le accuracy \le 1)$$

where $N$ is the number of elements in the USE. Similarly, reliability is defined by:

$$reliability = \frac{\sum_{j=1}^{N} \min(T_j, R_j)}{\sum_{j=1}^{N} R_j}, \qquad (0 \le reliability \le 1)$$

where $T_j$ and $R_j$ are the fuzzy set membership values for the target and response, respectively. Min($T_j$,$R_j$) means the minimum of the two quantities. The figure of merit (FM) is the *accuracy* × *reliability*.

The fuzzy set analysis for each trial occurred as follows. After the response was received by fax and while blind to the target, E1 scored each element in Table 2 as to the degree to which that element was contained in the response. If the response contained the word “waterfall,” then by definition, the *waterfall* element would receive a score of one. If, however, there was a vague sketch that might look slightly like a waterfall, then that element might only be scored as 0.3. Thus the entire USE was scored before E1 was shown the analysis target pack.
E1 then displayed five targets for the trial, performed the rank-ordering, the zero to seven point scale assessment and finally entered the two target-dependent fuzzy set elements. All results were inserted into a database for subsequent analysis.

To summarize, the fuzzy set elements for the targets were assigned, prior to the experiment, to represent the degree to which each element was visually impacting in the scene. The response elements were scored as to the degree to which the element was contained in the response. At this time, we have little evidence that a receiver is capable of not only recognizing that an element is in a target but also cable of determining its visual impact. For example, we rarely see a statement like, “There is a river in the target but it is hardly noticeable.” Thus, the target fuzzy set encoding contain more information that can be easily obtained with AC.

At this stage of our understanding of AC, we must be content with a simple recognition on the part of the receiver as to the presence or absence of a particular element. Therefore, prior to the calculation of the accuracy, reliability, and FM, we converted the target fuzzy set to a crisp set containing only ones for presence and zeros for absence for the membership values of the elements in the USE. This process is called an alpha cut in fuzzy set parlance. That is, we specify a threshold for the fuzzy set membership value so that if an element is equal to or above that threshold it is converted to a one or set to zero, otherwise. We adopted the threshold value of 0.2 in order the remove some of the noise “clutter” of 0.1 encoded elements. This value was empirically determined as a reasonable value (May, et al., 1990). An alpha cut was not applied to the response because the fuzzy element represented the degree to which the analyst felt that the given element was represented in the response.

Finally, we added two additional elements, which were independently scored for each target in the analysis pack, to the USE shown in Table 2. The element *visual*, which is an assessment of the degree to which the drawings, independent of the labels or other written material, matched a target image. The element *analytic*, which is the degree to which the written material, independent of the drawings, matched a target image. By definition, these elements were scored as one for all targets and were added to the consensus-scored fuzzy set representation of the targets. Thus in the equations for *accuracy* and *reliability*, $N$ is equal to 26, 24 elements coming from Table 2 and two being these additional elements.

## Entropy Analysis

An entropic analysis of a photographic image is an assessment only of intensity patterns and does not include any cognitive information. In this context, the gradient means transitions between light and dark regions. The details of how such an analysis is conducted can be found in May, Spottiswoode, and James (1994a). We will, however, summarize the approach here. The Shannon entropy for a single color plane with a depth of eight bits is given by:

$$S = -\sum_{j=0}^{255} p_j \log_2 p_j ,$$

where $p_j$ if the probability of observing an intensity value of $j$. We computed this entropy for all targets in the following way:

Each image was divided into $m$ ´ $n$ patches where we constrained the patch size to be evenly divisible into 800 and 600, the standardized target size. The patch sizes chosen were 4, 8, 20 40, and 100 pixels square. For a given size, we computed the entropy for each patch across the photograph. For example, using a patch size of 20, we would compute the entropy for each of the *40 ´ 30* different patches. The $p_j$'s were determined by the empirical values contained in each patch. Finally, using standard numerical techniques we computed the average absolute magnitude of the gradient[*] in this 2-dimensional entropy space. Figure 3, shows images that have low entropy gradient, the pyramid and high average gradient, the bridge.

Both entropy plots have the same vertical scaling of 20 bits. The steeper gradient of the "hills" and "valleys" in the bridge plot results in that image having 365% greater entropy gradient than the pyramid image.

The entropy gradient calculation was performed for all of the patch sizes shown above for all targets. Additionally we calculated what we call the total entropy where we computed a single value for the entire picture. That is, the single patch size was 800 × 600. All results were stored in the database for later analysis.

[*] The gradient is a formal measure of the "steepness" of the "hills" and "valleys" in the entropy space.

**Figure 3:** Low and High Entropy Gradient Images

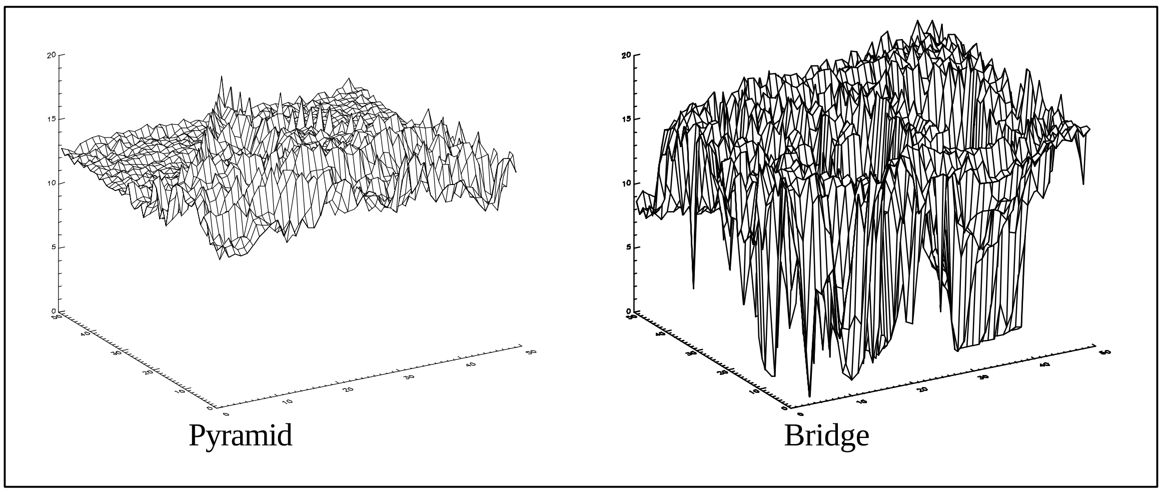


**Figure 4:** Entropy per Patch for the Two Images in Figure 3

### Correlation Analysis

To closely approximate the patch size that was used in our earlier studies (May, Spottiswoode, and James, 1994a), we adopted a patch size of $20 \times 20$ as the primary value for the correlation calculations. We will, however, examine any effects as a function of patch size. Similarly, we divided the assessment scale in half and used only the upper half for the correlation calculations, but we will examine any effects as a function of scale division.

For the correlation of gradient and entropy with the rating scale, we used the conservative, non-parametric Spearman's Rho method and converted the observed correlation to a standard normal deviate with Fischer's Z transform. The FM values are more nearly continuous as a consequence of its algorithm; however, even in this case we used the more conservative Spearman's $r$ to compute the correlation.

## RESULTS

The results fall into the two categories of evidence for AC and correlation effects. All p-values are quoted as single-tailed.

## AC Results

Table 3 shows the average rank, continuity-corrected effect size, and associated p-value for the five participants' 15 trials

| Receiver | Average Rank | Effect Size | P-Value |
|---|---|---|---|
| 8 | 2.867 | 0.070 | 0.392 |
| 127 | 3.267 | -0.212 | 0.795 |
| 221 | 2.933 | 0.024 | 0.463 |
| 497 | 2.933 | 0.024 | 0.463 |
| 937 | 2.933 | 0.024 | 0.463 |
| Totals | 2.987 | 0.004 | 0.486 |

**Table 3:** AC Results

The results, using the rank-order statistic, illustrated in Table 3 show no AC in this study either for individual receivers or overall. The effect size falls below what we have come to expect from this group of receivers. We shall return to this point in the Discussion Section below. Note that the effect size for the total is not the average of the effect sizes for the individual receivers. This is because taken as a study with 75 trials the continuity correction is different.

## Entropy Results

First we examine the correlation of the gradient of Shannon entropy with the assessment scale with values greater than three. With a patch size of 20, this correlation most closely replicates the earlier work.

For our primary hypothesis, which requires a correlation test with the figure-of-merit, we find a Spearman's $r$ for the average magnitude of the gradient of Shannon entropy correlated with the figure of merit of 0.212 with 73 degrees of freedom. This corresponds to $Z = 1.83$, $p = 0.034$. Figure 5 shows the scatter diagram for the gradient versus the figure-of-merit.

Even though the sum-of-rank statistic did not show significant evidence for AC, nonetheless, the primary hypothesis was confirmed. That is, the quality of the AC as measured by the figure of merit significantly correlated with the gradient of Shannon entropy for a patch size of 20. The points for the gradient are shown as ? 's, and the regression line is shown as the solid line in Figure 5.

The second hypothesis was also confirmed. The combined static target results from the previous two studies produced a strong correlation ($r = 0.161$, $df = 41$, $p = 0.152$). In this study, as measured by the upper half of the rating scale as shown in Figure 2, the gradient of Shannon entropy did correlate with the quality of AC ($r = 0.146$, $df = 23$, $p = 0.246$) at nearly the same level as before.

Finally the secondary hypothesis was confirmed as well. The correlation between the total entropy and the figure of merit was quite small ($r = 0.042$, $df = 73$, $p = 0.362$). The points for the entropy are shown as ×'s, and the regression lines is shown as dashed.

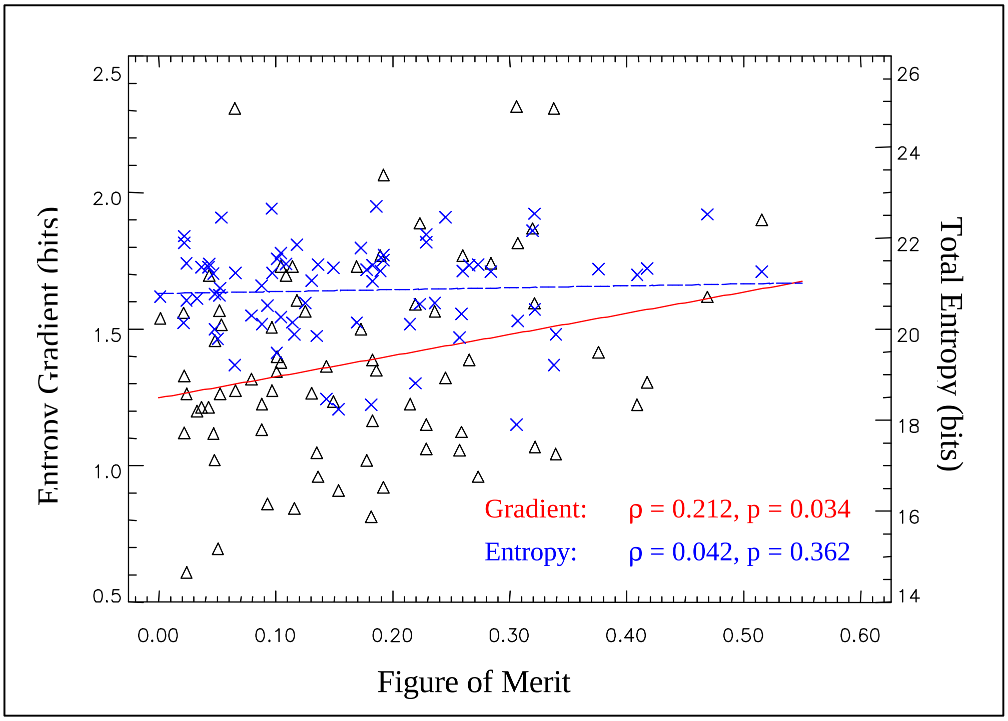


**Figure 5:** Correlation of FM with Entropy and its Gradient

## DISCUSSION

We discuss the result for the AC and entropy results separately.

### AC-Result

Utts (1994) has shown that our experienced receivers exhibit a consistency of AC effect size over time, a result consistent with our own observations. Because of this, we have come to expect significant results when, as in this study, we have sufficient statistical power to observe a significant result. When a study fails to exhibit significant evidence for AC, we are usually suspicious that some aspect of the protocol was responsible for the decrease in study effect size.

There were several protocol differences between this study and our usual method: a new target pool was used, the primary analysis was completed before feedback was given and the subjects were physically remote from the lab. We do not expect that the first two points are a factor, but the last probably is. This is not to suggest that distance between target and receiver is a modulating variable. Rather, we suggest that it is a matter of attention to the task. In the past, we have invited our receivers to the laboratory for their sessions. Many times this involved flying them across the US for a week visit on two or three separate occasions. In these cases, when a receiver was present in the laboratory, they had our full attention for the trial. All activity in the laboratory was focused upon that single trial.

In this study, the monitor called each receiver at a prearranged time and conducted a short session by telephone. The trials therefore amounted to relatively brief interludes in the otherwise busy schedules of receivers and experimenters alike. These are psychological conditions quite unlike the intense focus during trials in our earlier studies. There are numerous laboratory anecdotes about excellent AC performance under high attention. The Put to the Test AC trial that was shown on US National television is just one example.* In this example, approximately 10 people had their full attention on the trial that cost an estimated $100,000, and the result was a 1st place hit with near perfect correspondence.

These kinds of arguments can only be speculation, of course. One of the benefits of working with the same receivers over a protracted period of time is that our observed individual performance consistency allows such speculation. In this case, all of the receivers have been participating in experiments for over 15 years each. Further studies in which the receivers are in the laboratory will test this possible explanation.

## Entropy Result

### *Figure of Merit Assessment of the Quality of the AC*

As shown in Figure 5, we observed a significant correlation between the gradient of Shannon entropy and the quality of the AC as measured by the figure-of-merit. This correlation, however, was observed at a patch size of 20 × 20 pixels. The question arises about any possible dependency of the correlation upon patch size. Table 4 shows the patch size, Spearman's $r$ ($df$ = 73), its associated Z-score and P-value tested against $r = 0.0$

| Patch | Spearman's $r$ | Z-Score | P-Value |
|---|---|---|---|
| 4 | 0.218 | 1.879 | 0.030 |
| 8 | 0.218 | 1.879 | 0.030 |
| 20 | 0.212 | 1.828 | 0.034 |
| 40 | 0.121 | 1.035 | 0.150 |
| 100 | 0.079 | 0.672 | 0.251 |

**Table 4:** Patch-Size Dependence

Except for patch size of 40 and 100, we see a consistent correlation as a function of the patch size. Perhaps the decrease for the larger patches is because the details of the intensity features are lost as they become an increasing fraction of the picture. For example, consider an 800 × 600 pixel image. The patch of size of 40 and 100 correspond to 0.3% and 2.1%, respectively, of the total area. Clearly these numbers intimately depend upon the details of the target pictures in the study and do not generalize.

A more important consideration, however, is to consider what other circumstances might induce an apparent correlation between the entropy gradient and the figure of merit. Because the targets were chosen randomly, the probability of matching a given response to the intended target is 20% regardless of response bias on the part of the receiver or judging bias on the part of the analyst. In particular, analyst bias cannot systematically affect the figure of merit values because of this

* LMNO Productions, Sherman Oaks, CA, 28 November 1995.

blind assessment. Thus a number of potential artifacts are eliminated because of the differential match and the random selection of the target.

It might be, however, that there is some variable that correlates independently both with the gradient of the entropy and the figure of merit. One such candidate is the cognitive complexity of the target. If the gradient of the entropy correlated significantly with some measure of cognitive complexity, and the figure of merit did so as well, then the observed correlation of the gradient of the entropy with the figure of merit would contain an artifact.

As May et al. (1990) showed, a reasonable estimate for the cognitive complexity is the fuzzy-set sigma count for each target. The sigma count is simply the sum of the membership elements in the fuzzy-set representation of the target. The universal set of elements (USE) as shown in Table 2 represent high-level cognitive elements, whereas the USE that has been used in the past contained a large number of non-object features such as ambiance, color, and low-level linear features. May, Spottiswoode, and James (1994a) reported a small and non-significant correlation of target sigma count and the gradient ($r$ = -0.028, $df$ =98, $p$ = 0.609). For our current USE, however, the elements are all features that might contain significant intensity patterns and thus might show an overall correlation of gradient with sigma count.

As expected therefore, for all 300 targets in the pool, we observed a significant correlation between the gradient of Shannon entropy, computed for a patch size of 20, and the sigma count ($r$ = 0.199, $df$ = 297, $p = 2.59 \times 10^{-4}$). For the 75 targets that were selected in the study the correlation is larger ($r$ = 0.359, $df$ = 72, $p = 7.10 \times 10^{-4}$).

The correlation of the sigma count with the figure of merit, however, is quite small ($r$ = 0.0017, $df$ = 72, $p$ = 0.494). To determine the impact of these two correlations on the correlation of the gradient with the figure of merit, we consider a general case. Suppose that there is a significant correlation between variables $X$ and $Y$, r(X,Y). Suppose further that $X$ and $Y$ both independently correlate with a third variable, $Z$. We must determine the conditions for the magnitude of these independent correlations such that the observed r(X,Y) would be an artifact. Assume that the r(Y,Z) is unity (i.e., completely correlated). We then can replace Z with Y and consider r(X,Z) as r(X,Y). In this case, r(X,Y) is completely determined by r(X,Z). If r(Y,Z) is less than unity, than the contribution to r(X,Y) from the independent correlation with Z will be smaller than in the unity case.

In our case, the correlation of the figure of merit with the sigma count is $r$ = 0.0017 and the correlation of the gradient with the sigma count is $r = 0.217 < 1$. The contribution to the observed correlation of the gradient with the figure of merit for this potential artifact is therefore less then 0.0017.

### *Rating Assessment of the Quality of the AC*

For historical and replication reasons we examined the correlation of the gradient with the upper half of the blind rating scale shown in Figure 2. The Spearman's $r$ was 0.146 ($df$ = 23, $p$ = 0.246), which was consistent with the combined correlation of $r$ = 0.161, $df$ = 41, $p$ = 0.152 for the static targets in the earlier two studies (May et al., 1994a). Table 5 shows the correlation as a function of the rating scale division point. The ratings that were used in the correlation were equal to or greater than the cutoff value. The patch size for the entropy calculation was 20 pixels.

| Cutoff | Spearman's ρ | DF | P-Value |
|---|---|---|---|
| 0 | 0.130 | 75 | 0.192 |
| 1 | 0.159 | 69 | 0.097 |
| 2 | 0.086 | 71 | 0.275 |
| 3 | 0.035 | 34 | 0.422 |
| 4 | 0.183 | 26 | 0.188 |
| 5 | 0.087 | 9 | 0.416 |

**Table 5:** Correlation as a Function of Scale Division

There were no ratings of six or seven that were assigned to the feedback target.

## CONCLUSIONS

The primary and secondary hypotheses were confirmed. That is, the gradient of Shannon entropy of the target appeared to correlate with the quality of AC whereas the quality did not correlate with the entropy itself–a result that is suggestive of a sensory system.

We might legitimately ask how it is possible to see no AC in the study as defined by the accepted rank-order technique yet see a significant correlation with the gradient of the entropy? One way to understand this apparent contradiction is to examine closely the underlying assumptions of the two AC measurements that are involved–rank-order and figure of merit. It is clear that the rank-order technique is a relative measure that is strongly dependent upon the orthogonality of the set of photographs in a judging pack. As an example let's assume that the target is a small cabin next to a stream in the woods. Suppose further that a minimal response includes flowing water, but does not include the cabin or the woods.

In the best case scenario, suppose the pack orthogonality was such that only one picture contained any water at all. In this case, with a very modest amount of AC, an analyst would have no trouble making a first place match. In the worst case scenario, suppose the pack contained all five pictures with flowing water of various types, but only one contained a cabin in the woods as well. In this case the analyst would, on the average, end up with a third place match. Thus, we can see that the rank statistic for the same response strongly depends upon the photographs in the judging pack.

In the figure of merit analysis of this same example, it might be that the scores for all the photographs in the worst case scenario might be identical, say 0.15, because the response matches each target with about the same level of small correspondence. But in the best case scenario, the figure of merit analysis will give the same score for the stream-cabin-in-the-woods target (i.e., 0.15), but all the decoy targets will be lower. The point is that the figure of merit for the intended target is independent from the content of the judging pack.
Many trials in the best case scenario would likely yield a significant rank-order statistic, whereas in the worst case, the rank-order is exactly at chance. For the small amount of AC that was assumed in the example, one might come to each of these conclusions, depending upon the judging pack orthogonality.

In our case there is no question that the AC is far below what we have come to expect from our established receivers. Secondly, by the nature of our target pool bandwidth (May, Spottiswoode, and James, 1994b) it is very difficult to assure strong orthogonality.

In the past, these types of targets have done well when the AC functioning is strong; however, when the functioning as weak as in this experiment, there is a rough threshold of AC that is needed to produce a significant rank-order statistic. As we have illustrated from the example, it is most likely that the threshold is not zero. That is small amounts of AC might still produce a rank-order statistic near chance.

A correlation is algebraically not sensitive to the absolute level of one or both of its variables. We could add a large constant to either the gradient or the figure of merit and would find exactly the same correlation.

So we believe that we have replicated the earlier finding that the quality of AC is correlated with the gradient of Shanon entropy and not with the entropy itself. This result is a part of the growing, and perhaps, compelling evidence that AC is mediated through a sensory channel. This might be either some combination of the known senses or an additional one. Functional brain imaging may resolve this question by allowing us to directly observe neural functioning during anomalous cognition.

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## REFERENCES

Bem, D. J. and Honorton, C. (1994). Does Psi Exist? Replicable Evidence for an Anomalous Process of Information Transfer. *Psychological Bulletin*, **115**, 4-18.

Lantz, N. D., Luke, W. L. W., and May, E. C. (1994). Target and Sender Dependencies in Anomalous Cognition Experiments. *The Journal of Parapsychology*, **58**, 3, 285-302.

May, E. C., Spottiswoode, S. J. P, and James, C. L. (1994a). Shannon Entropy: A Possible Intrinsic Target Property. *Journal of Parapsychology*, **58**, 4, 384-401.

May, E. C., Spottiswoode, S. J. P, and James, C. L. (1994b).Managing the Target-Pool Bandwidth: Possible Noise Reduction for Anomalous Cognition Experiments. *Journal of Parapsychology*, **58**, 4, 303-313.

May, E. C., Utts, J. M., Humphrey, B. S., Luke, W. L. W., Frivold, T. J., and Trask, V. V. (1990). Advances in Remote-Viewing Analysis. *Journal of Parapsychology*, **54**. 193-228.