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ELECTRICAL SHIELDING, ESP, AND THE EARTH'S MAGNETIC FIELD

CHARLES T. TART

INTRODUCTION

Little known work by Puharich in the 1950's suggested that general extrasensory perception (GESP) performance in psychically talented percipients could be enhanced by having them work inside a solid wall shielded enclosure, a Faraday cage, if the cage was electrically connected to ground. An electrically floating cage apparently inhibited GESP performance. The present study tested these effects in a rigorous double blind design. Psychically talented percipients were not available, but thirteen undergraduate students alternated roles as percipients and experimenter/agents. The Circular Matching Abacus Test (matching ten cards without replacement) was used for testing GESP. There was significant above chance hitting in the grounded condition, as predicted. Scoring was at chance in the floating condition, as predicted. The possibility of electrically amplifying or inhibiting GESP performance can be of practical value and deserves further investigation. Further, GESP performance was significantly associated with lower values of the planetary geomagnetic field.

In attempting to explain the nature of extrasensory perception (ESP), a number of theories postulated that it involves some form of electromagnetic transmission of information. Insofar as this is true, we would expect ESP to have characteristics similar or identical to those involved in radio communication, such as detectibility by physical instrumentation and marked attenuation by both distance and electrical shielding. Since the bulk of the experimental data has not shown any physically detectible electromagnetic emissions, nor any consistent effects of shielding and distance other than those attributable to psychological factors, electromagnetic carrier theories of ESP currently have little useful explanatory power or practical application. Further detail on electromagnetic theories may be found elsewhere

(Chari, 1977; Tart, 1975; Tart, Puthoff, & Targ, 1979; Vasiliev, 1963). Nevertheless the possibility of ESP having an electromagnetic component continues to intrigue investigators, as linking ESP with known laws of electromagnetism would constitute a major scientific advance.

The possible existence of electromagnetic aspects of ESP was one of the reasons that led A. Puharich (1957; 1962) to conduct a variety of GESP experiments under various conditions of electrical shielding in the years 1950 to 1956. His work is little known, but if some of Puharich's findings are valid, they have considerable theoretical and practical consequences.

Puharich used a solid wall Faraday cage that was a six foot cube. It was covered with heavy sheets of copper plate, firmly glued to the plywood frame, with joints double rolled and continuously soldered. The door opening used spring bronze fingerstrip to insure continuous electrical contact all around the door. It rested on glass blocks.

His first experimental condition was to ground the cage to an earth stake. The second was to break the ground connection, leaving the cage electrically "floating" with respect to ground.

The ESP experiments Puharich worked with involved separated percipients matching the order of picture cards inside transparent boxes. Since telepathy and clairvoyance cannot be distinguished in this type of procedure, it is called a general extrasensory perception (GESP) test. He used agent/percipient teams preselected for demonstrated psychic ability. These teams could usually score statistically significantly above chance on the GESP test under ordinary room conditions, often showing significant ($P<.01$, one-tailed) scores in a single run.

Puharich found that under the grounded cage treatment, percipients' GESP hit rates often doubled or more compared to their already significant ordinary room performance. Under the floating condition, their scores fell to chance.

If Puharich's findings are valid, they are important for at least two reasons. First, appropriate use of Faraday cages might give us selective amplification or inhibition (shielding) of GESP performance. Second, such differences would be important in understanding the nature of GESP, suggesting at least an interaction with electrical or electromagnetic fields, even if the carrier mechanism of GESP is not per se electrical or electromagnetic.

The present study is an initial attempt to test Puharich's basic findings under stringent double blind conditions.

METHOD

Percipients and experimenters in this study were thirteen undergraduate psychology majors enrolled in my Experimental Psychology course in the winter quarter of 1984.

I informed the students that Puharich had investigated a wide variety of electrical treatments of Faraday cages, and apparently found some that amplified ESP, some that inhibited it, and some that had no effect. I explicitly told them that I was going to be intentionally vague about just how many effective treatments he had found or exactly what they were, as this was an area of the experiment that they had to be blind about in order not to introduce their psychological expectations as a source of systematic error. Variations in how well they did in any given run might be due to the experimental conditions and/or to extraneous factors, so they should just try to do as well as possible on every run. They accepted and understood this stricture, and waited until all the experimental data had been collected for me to fill them in on the details.

EXPERIMENTAL CONDITIONS:

An experimenter/agent began a session by sealing his or her percipient in our Faraday cage. The experimenter then turned on the power on a designated panel of vacuum tube electronics equipment, mounted in a rack of equipment near the Faraday cage, and then took the topmost card from a randomized stack of treatment specification cards. The first calibrated dial was set to the first number, the second dial to the second number, and a toggle switch to the C or D position.

These 18 possible equipment settings were intended to discourage the students from attempting to figure out what particular experimental conditions were, or to associate particular conditions with the score on a particular run. Only I knew that the electronics equipment had no function and the dial settings had no effects whatsoever: the toggle switch setting alone determined whether the Faraday cage was electrically grounded or floating.

THE UCD FARADAY CAGE:

The single wall Faraday cage in my laboratory is an eight foot cube. A storage battery operated incandescent lighting system furnishes illumination. The outer plywood skin is covered with a tar-impregnated roofing paper that has a thin (.005 inch) layer of copper electroplated on the outside of it. All joints are continuously soldered. The door edges are covered with spring bronze fingerstrip for tight electrical connection, as in Puharich's cage. No wires or ventilating openings break the electrical integrity of the cage. The agent/experimenter sealed the edges of the cage door with masking tape after the percipient had entered for the experiment. The air supply in the sealed cage was more than adequate for the brief (15-20 minutes at most) time a percipient was inside.

This cage shows the usual shielding effect when carrying a portable radio inside; almost all stations become detectable on both the standard AM and FM broadcast bands. The cage cannot be described as totally free of radio waves, however, for a high powered (5,000 watts) FM station located very close by (about 100 meters to the antenna) on campus can still be heard clearly. A thorough calibration of the cage has been carried out and will be published (Hubbard & Vincent, in press).

GESP TEST APPARATUS:

In the present experiment we used the Circular Matching Abacus Test (CMAT). Ten transparent boxes, each containing a distinct picture, comprised matching sets for the agent (sender) and percipient. Each set was arranged in slots on a circular board held on the lap. One slot is marked as the number one position. Agent and sender must try to match their arrangements by telepathic interaction. An average of one hit is expected by chance alone, with the Poisson distribution (parameter one) being an excellent approximation to the exact multinominal distribution.

SESSION PROCEDURE:

One or two runs were usually done in a single session. After spending a few minutes establishing rapport in whatever way seemed appropriate, the percipient entered the Faraday cage with his or her response board. The agent/experimenter then taped the cage door shut, turned on the Faraday cage treatment apparatus, took the top card from the conditions cards, set the appropriate dial and switch settings, and then shouted to the percipient, through the wall of the Faraday cage, that sending would start in about two minutes.

The agent then left the room containing the Faraday cage, locked its door, and entered a locked room across the hall. The exact arrangement of rooms is shown elsewhere (Figure 6 in Tart 1975;1976). The agent then thoroughly (at least 8 - 10 times) hand shuffled a deck of ordinary playing cards from which the face cards had been removed, and then used the first ten number cards from this deck that did not repeat, to randomly arrange the ten plastic boxes containing the target cards on his or her circular layout board.

The agent/experimenter concentrated on sending the order of the target arrangement for ten minutes (using a timer), and then wrote down the target order on the agent's data sheet. He or she then reentered the room containing the Faraday cage and shouted "Finished!" The agent/experimenters were aware that they could not say anything else, to avoid any possibilities of cuing. The percipient, who had meanwhile been arranging the target boxes on his or her response board to try to match the order on the agent's target board, now wrote down their order and then left the cage. The number of hits (identical target cards in identical positions) was then counted. The response order was also copied on to the agent's target order sheet, with both agent and percipient checking that this was done accurately.

RESULTS

The random scheduling of treatment conditions resulted in 76 runs being carried out in the grounded condition and 74 in the floating condition. There were a total of 93 hits in the 76 runs of the grounded (predicted GESP-facilitating) condition. This is a mean hit rate of 1.22 hits per run, as opposed to a chance expectation of one hit per run. A calculation using the Poisson distribution gives P=.032, one-tailed.

There were 67 hits in the 74 runs of the floating (predicted GESP-inhibitory, chance results) condition, a mean of 0.905 hits per run. The Poisson probability of obtaining a deviation of seven or more from the mean is .4147, two-tailed, .227, which is not significant.

As predicted from Puharich's work, scoring was higher in the grounded condition, with a mean hit rate of 1.22 hits per run, compared to a mean hit rate of 0.905 hits per run in the floating condition. The distributions of hits in each condition are not normally distributed, so they were compared with a Mann-Whitney U-Test. U = 2304.50 with a corresponding Z-score of Z = 1.91, with P=.03, one-tailed.

Performance in the floating and grounded treatment conditions is plotted in Figure 1. As can be seen, there were more than 50% more zero hit runs in the floating condition, and a small but uniformly higher hit rate for one, two, three or four hits in the grounded condition.

GESP PERFORMANCE AND GEOMAGNETIC FIELD VARIATION:

Recent years have seen great interest in the possible effects of various kinds of electromagnetic radiation on animal and human physiology and performance (Adey, 1981). Adams (1985) retrospectively analyzed a data base of remote viewing (RV) trials, in which percipients try to use GESP to describe the surroundings of experimenters who are at some randomly selected location distant from the laboratory. The general procedure and results of remote viewing studies are well described in the literature (Targ & Puthoff, 1977; Tart, Puthoff, & Targ, 1979; Targ & Harary, 1984). Each of the RV trials was rated on a 0-7 scale, with 0 indicating nothing at all in the viewer's description that could relate to the RV target, and 7 (a rating almost never used) indicating an almost photographically accurate and correct description of the target, including abstract analytical information such as correct naming of prominent target items. The scale has been fully described in Targ, Targ & Lichtarge (1985). Adams started with a total of 515 RV trials and selected those that were rated as 5.0 ("Good correspondence with unambiguous unique matchable elements, but some incorrect information.") or greater, or as 2.0 ("Some correct elements, but not sufficient to suggest results beyond chance expectation.") or less. This yielded 72 high performance RV trials and 48 low performance ones.

Because perturbations in the GMF field may be correlated over several days, Adams compared geomagnetic activity on four, three, two, one and zero days before each RV session for high and low performance RV sessions. She found that Sigma K_p, a daily measure of variability of the most unsettled horizontal component of the earth's GMF field, was lower (calmer geomagnetic "weather") for the days of high performance RV trials and for the four days preceding these trials, compared to low performance RV sessions. This difference was greatest for one day before the RV session and was significant at P < .005 (two-tailed[2]). For this day preceding the RV trial, the low RV performance days showed about 30% higher GMF activity, judging from Adams' Figure 1. Analyses with the planetary A index (also represented in some reports as A_p) generally paralleled that with Sigma K_p.

Persinger (1985a; 1985b; 1985c; Persinger & Schaut, in press; Schaut & Persinger, 1985), working from a well-developed theoretical model implicating extremely low frequency (ELF) electromagnetic radiation and GMF perturbations as factors affecting human behavior, analyzed three independent samples of spontaneous GESP cases of apparent telepathy or clairvoyance. The first was a rigorous case collection of Stevenson's (1970). Twenty-five cases had sufficient date information for analysis. Using the aa or antipodal index of GMF activity developed by Mayaud (1973), Persinger found that the mean aa index on the days of these spontaneous cases was significantly lower (10 ± 3.5) than the mean aa for seven days before or after the experience (18.45 ± 10, P < .001, one-tailed).

His second sample consisted of 78 old but exceptionally well-verified cases from Phantasms of the Living (Gurney, Myers & Podmore, 1886). Again the mean aa index was 10 (± 1.0) for the days of the experiences, significantly lower than the mean value of 15 (± 3.0) for the days preceding or following. As an especially interesting control, Persinger similarly analyzed 31 other cases from this collection that showed some discrepancies in verification, and so might not be genuine instances of GESP. The aa values on the days of those cases did not differ significantly from the days preceding or following them.

Persinger's third sample consisted of 57 cases of ostensible spontaneous telepathy or precognition from Fate magazine which were precisely dated. Again the mean aa index was lower on the days of the experiences (13.5 ± 10.9) than on preceding and following days (21 ± 15). A sample of 56 ostensible precognition cases from Fate, where a different GESP mechanism might theoretically be expected to be involved, did not show such differences. Note that these are large differences, with the aa index being 50% to 80% higher on control days.

Note that both Adams' and Persinger's studies dealt with relatively high level manifestations of GESP. In Adams' study remote viewers had generally been selected and trained for high level performance, and the apparent magnitude of GESP in the spontaneous cases in Persinger's studies was generally very high. To introduce new terminology analogous with that currently being used in psychokinesis (PK) studies, Persinger especially and Adams often were dealing with manifestations of macro-ESP. The typical forced choice laboratory GESP study, on the other hand, has much lower level results. Typically a group of percipients might average 51% success on a binary guessing task, and over many trials this might be statistically significant, but unlikely to impress ordinary people who are not versed in the abstract reasoning of statistical tests. Thus, most laboratory work deals with micro-ESP. Because my Faraday cage study showed micro-ESP effects, any link between GESP performance and GMF factors would have to be strong to emerge.

ANALYSIS FOR GEOMAGNETIC EFFECTS:

I followed Adam's (1985) analytic procedure of dividing the data into high and low performance runs. High performance was here defined as a run score of three or more hits ($P \leq .08$, one-tailed), while low performance was defined as a score of zero hits. This division was decided on prior to inspecting the GMF data.

The Mann-Whitney U-Test was used to compare daily GMF values for the planetary A index, a daily average measure of the range of variation of the horizontal components of the GMF. The U-Test was used in preference to a conventional t-test as the distributions of A values in this study departed markedly from the normal. A high (20+) A index represents a "stormy," highly variable geomagnetic day, while a low one is a "calm" day. Following Adams, I analyzed the four days preceding and the day of my students' GESP sessions. Since this is an initial attempt on my part to investigate Adam's and Persinger's findings, under conditions of much less GESP involved in my study than in theirs, I have not corrected the P-values below for multiple analyses.

Figure 2 shows the mean A values for high- and low-scoring GESP runs mixed through both electrical conditions of the Faraday cage. As with Persinger's findings with the aa index and spontaneous cases, I found high GESP performance days associated with quieter GMF activity than low performance days on the day of the GESP test (U = 363.00, P - .056, one-tailed).

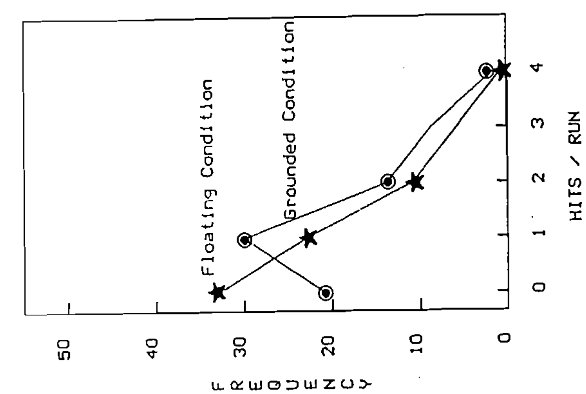

Fig. 1 Differential GESP hitting performance in the grounded and floating Faraday cage conditions. The higher number of hits in the grounded condition is significantly different from the number in the floating condition by a Mann-Whitney U-Test, with P = .03, one-tailed.

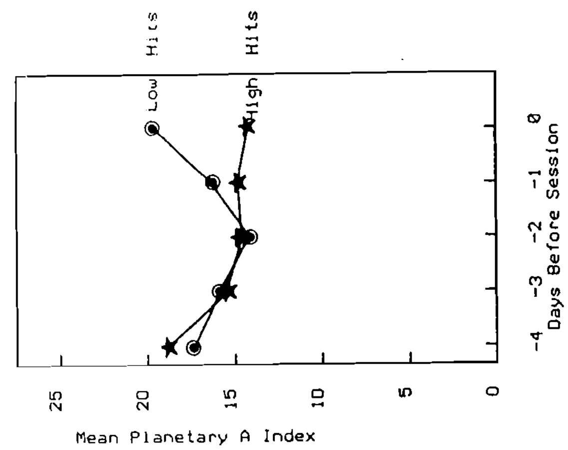

Fig. 2 Geomagnetic Field activity as a function of high and low GESP scoring activity, planetary Ap index, irrespective of the electrical condition of the Faraday cage enclosure.

None of the four days preceding the GESP runs showed statistically significant differences in geomagnetic activity between high- and low-scoring runs, in contrast to Adams' finding.

At biologically active frequencies of 10 Hertz or less, the UC Davis Faraday cage would be essentially completely transparent to electromagnetic radiation, i.e., be expected to have no shielding effect at all, whether grounded or ungrounded. But because the electrical condition of the Faraday cage, grounded or floating, affected GESP scoring, I separately carried out the same analyses as above for the grounded and floating conditions. The results are shown in Figures 3 and 4.

The relationship of GMF activity with GESP run performance falls to small, non-significant differences when the Faraday cage is in its most effective shielding mode, namely grounded. When it is electrically floating, in its less effective shielding mode, however, the effect of lower GMF activity being associated with higher GESP performance reappears (U = 72.50, P = .063, one-tailed) for the day of the tests. A similar and more significant effect appears for the geomagnetic effect three days prior to the tests (U = 47.50, P = .008, one-tailed). This is consistent with Adams' finding of generally lower GMF activity for several days prior to more successful remote viewing experiments.

DISCUSSION

Puharich's research suggested that a grounded Faraday cage would enhance GESP performance <u>in psychically talented percipients</u>, and that a floating Faraday cage would inhibit their normally significant performance, dropping it to chance levels.

Although the present study suffered from the handicap of not having known psychically talented percipients available, nevertheless significant hitting occurred for percipients in the grounded Faraday cage condition, as predicted. The GESP scoring rate was at chance in the floating condition, as predicted, and the difference in hit rate between conditions was statistically significant. Psychological bias as a systematic source of variation was eliminated by the double blind design used, unless one wants to postulate some sophisticated GESP on my part. Thus, I consider these results an initial confirmation of Puharich's early findings.

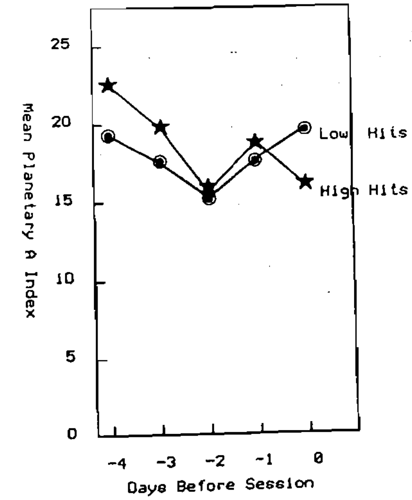

Fig. 3 Geomagnetic field activity as a function of high and low GESP scoring activity, planetary A_p index, in the electrically grounded (GESP facilitory) condition of the Faraday cage.

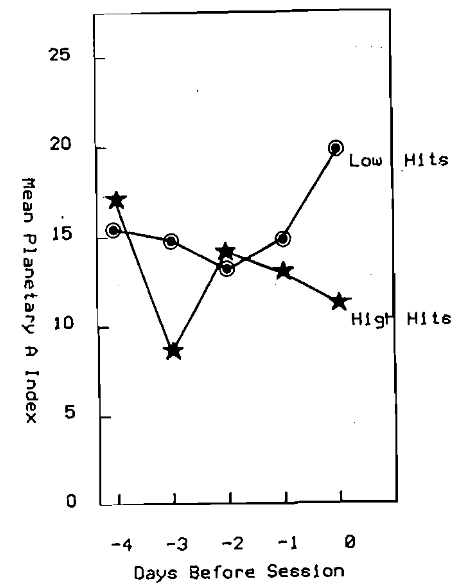

Fig. 4 Geomagnetic field activity as a function of high and low GESP scoring activity, planetary A_p index, in the electrically floating condition of the Faraday cage.

I have repeatedly emphasized that one of the greatest problems in parapsychological research is the typically inconsistent, unreliable, and statistically-significant-but-practically-trivial manifestations of GESP in the laboratory (Tart, 1980). This fosters non-acceptance of GESP in the general scientific community and creates considerable inefficiency in process oriented research designed to elucidate the mechanisms of GESP. Because of the use of unselected and largely psychically untalented percipients in the present study, the magnitude of GESP obtained was small. If psychically talented percipients were used in the grounded Faraday cage condition, GESP manifestation might reach practical levels of usefulness. Puharich's early work suggested that talented percipients' GESP scoring could at least be doubled. The usefulness of such amplification, as well as its inherent theoretical interest, is obvious, and indicates that research on the Faraday cage effect should have high priority.

As to the correlations of GESP performance with geomagnetic field variation, the present results provide general support for both Adams' and Persinger's findings of quieter GMF "weather" being associated with superior GESP performance. This is encouraging but not conclusive support, due to the weak level of GESP in this experiment and the use of multiple analyses. Since GMF fluctuations may have consequents for days afterward, we need a much larger data base to see just what the exact time relationship between GMF activity and GESP performance, if any, is.

I do not understand the possible mechanism behind these findings, so shall not speculate here. Regardless of our understanding of mechanism, however, more research is warranted because of the possible practical usefulness of amplifying GESP performance by employing Faraday cages and working on geomagnetically quiet days.

For the researcher who wants more details, I plan to discuss these results in greater detail elsewhere (Tart, in press; submitted).

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