GEOMAGNETISM AND PSI IN THE GANZFELD

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ABSTRACT

Prior literature suggests that psi perception may be better when the planetary geomagnetic field is relatively quiet. This possible geomagnetic-psi relationship was analysed in two ganzfeld psi experiments, one with normal and the other with creatively-talented participants. Both ganzfeld experiments consisted of 32 sessions. The experiment using a normal population resulted in a chance-expected hit rate of exactly 25%; the creative population resulted in a hit rate of 41% (exact binomial $p = 0.016$).

For the normal population, when psi performance was better, geomagnetic field fluctuations were lower ($p < 0.001$, two-tailed). The opposite was observed in the creative population: better psi performance was associated with higher geomagnetic fluctuations ($p < 0.05$, two-tailed). Differences in methods of studying geomagnetism-psi relationships are discussed.

INTRODUCTION

A growing body of evidence suggests that psi performance in perceptual tasks is related to fluctuations in the planetary geomagnetic field (Adams, 1986; 1987; Arango & Persinger, 1988; Berger & Persinger, 1991; Haraldsson & Gissurarson, 1987; Lewicki, Schaut & Persinger, 1987; Makarec & Persinger, 1987; Persinger & Schaut, 1988; Persinger, 1985; 1987; Persinger & Krippner, 1989; Schaut & Persinger, 1985; Spottiswoode, 1990; Wilkinson & Gauld, 1993). The basic claim is that psi perception (i.e. telepathy, remote viewing, clairvoyance) as reported both in controlled laboratory studies and spontaneously in real life is better when geomagnetic field fluctuations are low, or quiescent, and worse when geomagnetic fluctuations are high, or stormy. Other geomagnetic relationships are claimed for psychokinetic effects (e.g. Braud & Dennis, 1989), but in this paper we only consider psi perception.

The literature is surprisingly consistent in suggesting the existence of a geomagnetic-psi relationship, but to date no studies have explored how the geomagnetic effect might interact with other factors thought to be related to psi performance, such as personality, creativity, or special talents. As a start in this direction, we examined the effect of geomagnetic field fluctuations on the outcomes of two ganzfeld telepathy studies using different subject populations.

Both populations were drawn from undergraduates at the University of Edinburgh (excepting one person). One population consisted of 'normal' student volunteers while the other was drawn from those identified as creative musicians and artists. The creative students were specifically selected in an attempt to replicate Schlitz and Honorton's (1992) finding that a creatively-gifted population produced a large hit rate (50%, where 25% was chance expectation) in a ganzfeld experiment.

Geomagnetism and Psi

More detailed reviews of the possible relationships between geomagnetism and human performance can be found in the above references. Briefly, the earth is surrounded by a field much like the magnetic field surrounding an ordinary bar magnet. One difference is that the earth's magnetic field measures about half a Gauss at the surface of the planet, while a typical bar magnet's field strength can be hundreds or thousands of Gauss.

A more important difference is that a bar magnet's magnetic field is static while the earth's magnetic field is dynamic, constantly fluctuating as the earth is buffeted by solar particles and other extraterrestrial influences. These fluctuations are recorded by several dozen magnetic observatories scattered around the globe, transformed into several types of magnetic indices, and the data then distributed via scientific research services such as the British Geological Society (UK) and the National Oceanographic and Atmospheric Administration (USA).

The magnetic index used in the present study is known as the *planetary A-index* (PAI), a daily estimate of the better-known *ap* index. This index was retrieved from the Internet computer network as part of a daily broadcast service called the *Solar Daily Geophysical Bulletin*. Daily PAI estimates were used instead of the *ap* indices because this analysis was conducted before the *ap* indices were available (there is typically a delay of several months before *ap* indices are published, whereas the PAI index is available within one day). PAI summarizes magnetic *fluctuations* for the entire globe; it is not an absolute measure of the magnetic field.

METHOD

Ganzfeld Experiments

The experiments involving the two subject populations were conducted during the same six-week period in the ganzfeld laboratory facilities of the Koestler Chair of Parapsychology at the University of Edinburgh. Experimenter SM, the second author, was a fourth-year (senior) psychology student, who conducted the ganzfeld sessions with pairs of volunteers from a normal student population. Experimenter SC, the third author, was a medical-school student, who conducted the ganzfeld sessions with pairs of students known to her as being either musically or artistically talented. These experiments were primarily designed to explore various personality and belief correlates to psi in the ganzfeld, and were conducted under the guidance of Prof. Robert Morris, Koestler Professor of Parapsychology.

The experiments used a computer-controlled audio/video ganzfeld testing facility designed by the late Charles Honorton, and a semi-automated experimental protocol outlined by Robin Taylor. The facility consisted of a sound- and electromagnetically-shielded receiver's (R) room, an adjacent experimenter's (E) control room, and a sender's (S) room located some 30 metres away. This ganzfeld set-up is essentially a newer-technology replication of an automated ganzfeld system used for a long series of studies at Honorton's Psychophysical Research Laboratories (PRL) (Honorton et al., 1990).

The main outcome of each experimental session was R's ranking of each of four video clips, one of which was the actual target 'sent' by S, and three were decoys. The present analysis uses the rank assigned to the actual target (i.e. 1 to 4) as the primary data-point per session. A pre-planned total of 32 subject-pairs were run in each of the two population conditions.

Geomagnetic Analysis

This analysis was primarily interested in the relationship of geomagnetic fluctuations to the outcome of the ganzfeld session. Detailed findings of the ganzfeld studies, e.g. correlations with personality factors, use of dynamic vs. static targets, etc., will be reported in other papers.

Geomagnetic indices (i.e. PAI) were retrieved for each day on which a ganzfeld session was conducted (27th January to 4th March, 1993) *after* all sessions had been completed. The geomagnetic analysis was conducted specifically after all data were collected to avoid the possibility that knowledge of geomagnetic fluctuations during the experiment might bias experimenters' expectations for individual sessions. In fact, neither experimenter (SM or SC) was aware of the literature on possible geomagnetic-psi correlates until after all data were collected; thus these experiments were conducted double-blind with respect to the present hypothesis.

Both experimenters ran their studies concurrently mainly for scheduling considerations, but this also made it possible to examine geomagnetic effects conveniently in two populations exposed to essentially the same geomagnetic environment at the same location.

Results

Ganzfeld Hit Rate

Figure 1 summarizes results of the two experiments. The normal population study resulted in 8 direct hits in 32 sessions (25% hit rate) and the creative population resulted in 13 hits in 32 sessions (41% hit rate, exact binomial $p = 0.016$). Combined, this is a 33% hit rate ($p = 0.059$), which conforms closely to the 34.4% hit rate obtained in the PRL autoganzfeld series (Honorton et al., 1990).

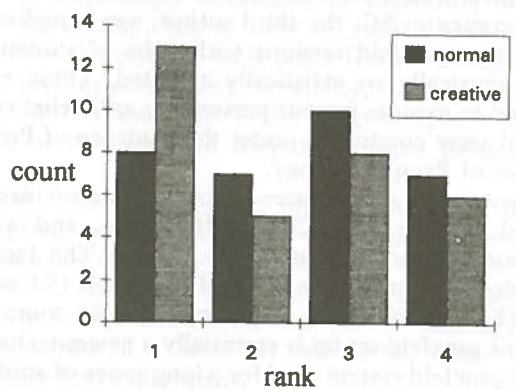

Figure 1. Distribution of target ranks for the normal and creative subject populations.

Besides the combined results replicating the expected autoganzfeld effect size (in terms of hit rate), it was interesting to see that the creative population resulted in a 41% direct hit rate, which was not quite as high as the 50% hit rate obtained in the Schlitz and Honorton (1992) study using a creative population, but substantially larger than the 34.4% meta-analytic estimate for the general population (Honorton, 1985).

Geomagnetism

Geomagnetic Variations

Figure 2 shows the raw PAI values recorded over the course of the two experiments. Experimental sessions were conducted on the days indicated by the open squares.

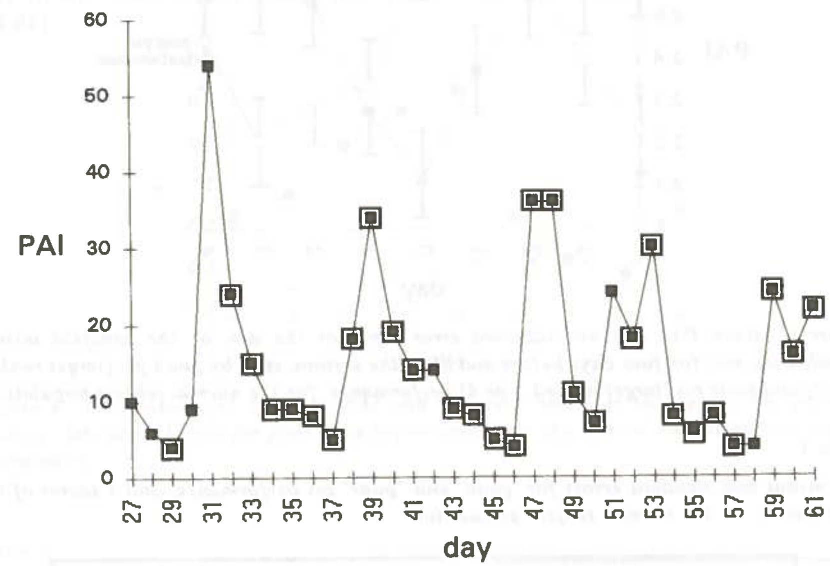

Figure 2. Planetary A-index over the course of the two ganzfeld experiments. Open squares indicate days on which ganzfeld sessions took place. From one to three sessions were conducted on these days. The number on the x-axis corresponds to the number of the day in the year, thus Day 33 corresponds to 2nd February 1993.

Geomagnetism-Psi: Normal Population

To examine whether geomagnetic fluctuations affect study outcomes, the following procedures were used. For each experimental population, session outcomes were split into two groups: those where the actual targets were ranked 1 or 2 (nominally labelled 'good' performance) and those where they were ranked 3 or 4 ('poor' performance). Then the means and standard deviations of PAI values for the 'good' and 'poor' groups were calculated,[1] and the difference between good and poor means was compared with a t-test.

[1] All PAI analyses were performed on natural-log-transformed values to reduce the effect of PAI outliers, thus wherever 'PAI' occurs in the text it means 'natural log of PAI'.

Because the literature also suggests the presence of a geomagnetic-psi relationship for magnetic fluctuations the day before the psi performance, the above good-poor split was repeated, except that instead of using the PAI value for the *day of* each session, the PAI value for the *day before* each session was used. Another t-test was performed for this 'one-day-lag' analysis, and then the same process was repeated again for up to four days before and four days after the day of the actual session, creating a total of nine t-tests.

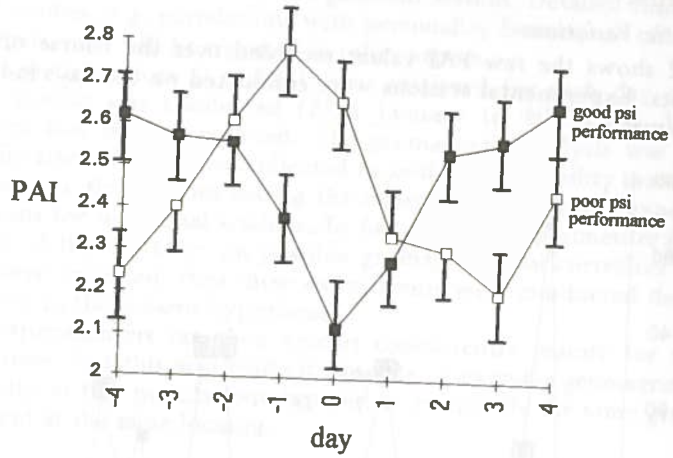

Figure 3. Mean PAI and one-standard-error bars for the day of the ganzfeld session (labelled 0), and for four days before and after the session, split by good psi (target ranked 1 or 2) and poor psi (target ranked 3 or 4) performance; for the normal subject population.

Table 1

PAI means and standard errors for 'good' and 'poor' psi performance, and t scores of the differences; for the normal subject population.

day	PAI (good)	se	PAI (poor)	se	t (30 df)
-4	2.617	0.206	2.238	0.152	1.904
-3	2.568	0.199	2.397	0.190	0.886
-2	2.564	0.210	2.609	0.173	-0.223
-1	2.382	0.145	2.778	0.185	-2.827
0	2.119	0.167	2.655	0.157	-3.312
1	2.276	0.179	2.338	0.163	-0.358
2	2.536	0.217	2.311	0.124	1.067
3	2.573	0.185	2.214	0.157	1.999
4	2.660	0.146	2.451	0.182	1.477

The literature predicts that geomagnetic fluctuations will be lower on days of good performance compared with days of poor performance, thus a *negative* t-score was predicted. Figure 3 shows the PAI means (and standard errors) for the normal population, separated by good and poor psi performance. Table 1 lists the same information, including the t scores of the difference between good and poor PAI means.

Another way of examining the geomagnetic-psi relationship is by calculating the correlation between the geomagnetic index (PAI) and the psi-performance measure (target rank). The expected correlation in this case would be positive: PAI increasing as rank increases. Figure 4 plots these correlations for the day of the session and plus and minus four days; Table 2 lists the correlations and t tests for the significance of the correlations. The largest correlation is on the day of the session, but it does not quite reach significance ($r = 0.23$, $t = 1.29$, 30 df).

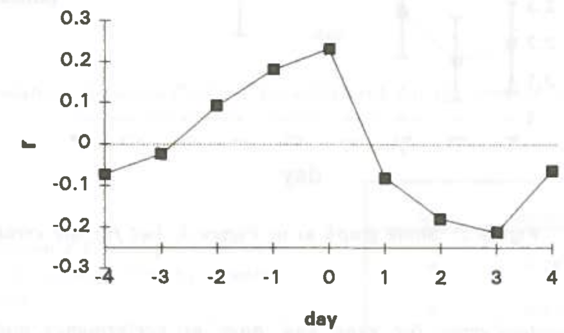

Figure 4. Correlation (r) between PAI and ganzfeld rank for the day of the ganzfeld session (labelled 0), and for four days before and after the session; for the normal subject population.

Table 2

Correlations between PAI and ganzfeld rank and associated t scores for the day of the ganzfeld session (labelled 0), and for four days before and after the session; for the normal subject population.

day	correlation	t (30 df)
-4	-0.072	-0.395
-3	-0.0236	-0.129
-2	0.0916	0.504
-1	0.1799	1.002
0	0.2302	1.296
1	-0.0806	-0.443
2	-0.1797	-1.001
3	-0.2128	-1.193
4	-0.0631	-0.346

Geomagnetism-Psi: Creative Population

Now we examine the same relationships for the creative population. Figure 5 and Table 3 show that the geomagnetic-psi relationship produced by the creative population was nearly a mirror image of that for the normal population.

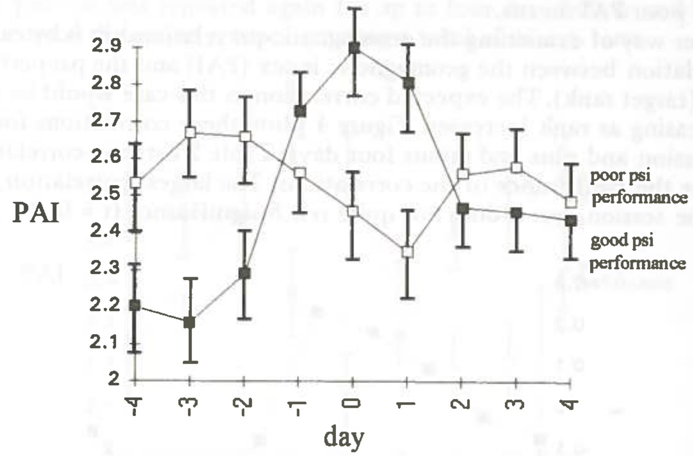

Figure 5. Same graph as in Figure 3, but for the creative population.

Table 3

PAI means and standard errors for 'good' and 'poor' psi performance, and t scores of the differences; for the creative subject population.

day	PAI (good)	se	PAI (poor)	se	t (30 df)
-4	2.197	0.164	2.532	0.18	-1.746
-3	2.163	0.147	2.672	0.163	-2.962
-2	2.288	0.161	2.656	0.167	-1.955
-1	2.726	0.175	2.558	0.174	0.822
0	2.898	0.133	2.458	0.185	2.828
1	2.814	0.129	2.353	0.192	3.062
2	2.475	0.139	2.556	0.188	-0.498
3	2.457	0.141	2.584	0.198	-0.768
4	2.438	0.142	2.491	0.136	-0.321

Given the above results, it is not surprising to find, in Figure 6 and Table 4, that the correlations produced by the creative population are also near-reversals of the normal population results. The predicted correlation at Day 0 is positive;

instead we see fairly strong negative correlation. And it is interesting to note, *post hoc* of course, that the correlation at Day +1 is significant two-tailed at $p < 0.05$ ($r = -0.36$, $t = -2.09$).

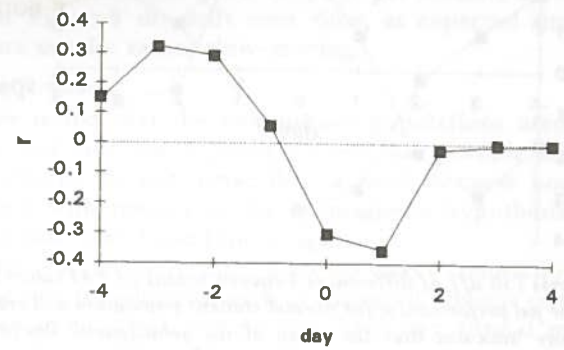

Figure 6. Correlations between PAI and ganzfeld rank for the creative subject population.

Table 4

Correlations between PAI and ganzfeld rank and associated t scores; for the creative subject population.

day	correlation	t (30 df)
-4	0.1475	0.817
-3	0.3226	1.867
-2	0.2914	1.668
-1	0.0547	0.300
0	-0.3056	-1.758
1	-0.3569	-2.092
2	-0.0209	-0.115
3	-0.0064	-0.035
4	-0.0057	-0.031

Figure 7 presents a *post-hoc* comparison of the above results in terms of t-scores of the differences between mean PAI values for good and for poor psi performance. Here we see more clearly the expected geomagnetic-PAI result for the normal population—better performance occurred on days of lower geomagnetic activity—and the unexpected reversal for the creative population. It is worth noting that the curious V-shaped curve that is observed in both experiments seems to be in accordance with Roney-Dougal and Vogl's (1993) speculation that what matters is not the direction of geomagnetic changes, but the magnitude of the changes.

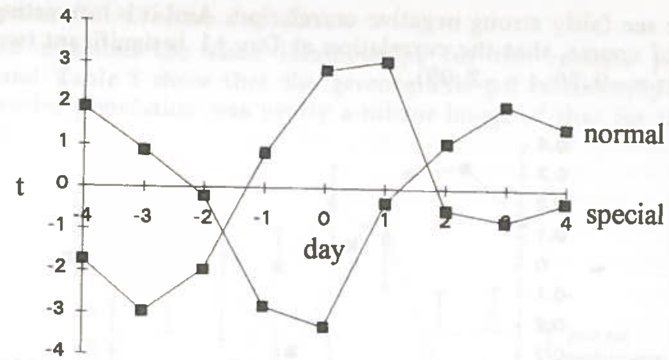

Figure 7. T-scores (30 df) of differences between means of PAI values obtained on days of good and poor psi performance; for normal student population and creative population. A negative t-score indicates that the mean of the geomagnetic fluctuations on 'good' performance days was lower than the mean for 'poor' performance days.

Discussion

Test for Methodological Artifacts

To test the possibility that the above results were due to peculiarities in geomagnetic indices or some calculation artifact, a Monte Carlo simulation was conducted. The original days of the *normal population* experimental sessions were maintained, but new, randomized *ranks* (i.e. psi outcomes) were assigned to those sessions.[2] A good vs. poor split analysis, the same as described above, was applied to this new, randomized dataset, and the means and standard deviations of the resulting 'good' vs. 'poor' PAI indices were determined.

Only the normal population dataset was tested in this fashion, because that experiment resulted in no overall evidence for psi in the ganzfeld; thus the apparently-observed geomagnetic-psi relationship was most unexpected.

This entire process was repeated 1,000 times to form PAI simulated grand means and standard errors, then plotted for plus and minus four days (as in Figure 3). Results are presented in Figure 8. The standard errors in Figure 8 are approximately the height of the little boxes.

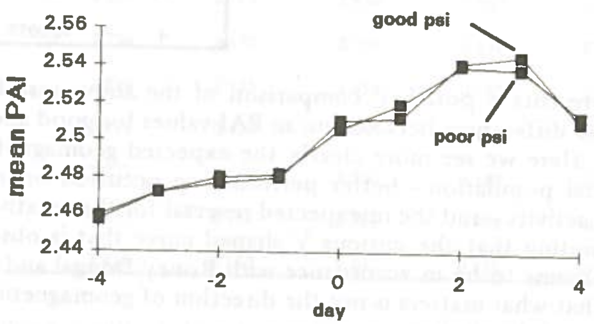

Figure 8. Monte Carlo PAI means for good and poor psi, using randomized ranks dataset.

[2] The Microsoft QuickBasic pseudorandom generator 'RND' was used in these simulations.

The Monte Carlo simulation indicated that there was no inherent bias in the evaluation method, or in the ganzfeld rankings, that would artifactually produce the significant results seen in Figure 3. That is, the differences between PAI means during simulated good vs. poor psi sessions are minuscule. The PAI means in Figure 8 do drift over time, as expected since geomagnetic fluctuations are usually rather slow-moving.

Population Differences

It should be noted that the two subject populations used in the present analysis were not selected *a priori* to test for possible interactions with geomagnetic effects. In one sense this is good, because both studies were conducted blind with respect to the geomagnetic hypothesis, and therefore they could not have been biased for or against it.

But it is also bad, because there were no direct comparisons between the subjects in the two populations, such as having all subjects complete the same creativity inventories. Thus, we do not have any formal measure of how the two populations differ. All we know is that one study used 'normal' volunteers while the other used 'artistically or musically creative' volunteers.

Clearly, before theories are proposed as to why normal and creative populations might produce mirror-image geomagnetic effects, the present observation must be replicated. Ideally, replication studies should use a quantitative measure of 'specialness' to discriminate between the subject populations. In the meantime, study factors possibly related to the geomagnetic effect can be examined by performing a retrospective analysis of a large ganzfeld database (Honorton et al., 1990) where specially creative participants (students from the Juilliard school) are identified. This analysis will be reported in a future paper.

Other Issues

The 'geomagnetic effect', partially replicated here, raises a number of perplexing questions. For example, it is a mystery why very small fluctuations in the planetary geomagnetic field should correlate with any human performance at all. Even if geomagnetic effects are related to temporal-lobe disturbances, as postulated by Persinger (1989), and this is somehow related to psi performance, this does not persuasively explain why intense local magnetic fluctuations caused by motors, computers, hair-driers, etc., do not completely swamp the tiny changes in the earth's magnetic field. There is also a problem in that conventional biophysics predicts that changes in the earth's magnetic field are not strong enough to produce *any* physiological effects on the human body at all (Adair, 1991).

One speculation is that we are constantly exposed to geomagnetic fluctuations while local magnetic effects from motors, etc., tend to be temporary. Another possibility is that we are sensitive only to particular geomagnetic frequencies while man-made magnetic fields tend to be at different frequencies (Becker, 1990). Still another is a proposed geomagnetic-pineal-gland relationship (Roney-Dougal & Vogl, 1993).

Beyond the mystery of mechanism, there may be some confusion over what is actually being claimed about geomagnetism. Studies examining geomagnetic-psi relationships have taken three general forms:—

For spontaneous psi, the geomagnetic field is studied on days of reported psi events versus the geomagnetic field on surrounding days or weeks. The claim is that spontaneous psi is reported to take place on days of lower geomagnetic fluctuations as compared with recent geomagnetic conditions. Call this Method 1.

For experimental studies there are two approaches: 'good' and 'poor' psi trials are separated into two groups and the mean geomagnetic field strengths for the two groups are compared. We took this approach, called Method 2, in the present study. The third approach is to form a correlation between psi measures (such as ranks, or Z scores, or effect sizes) and geomagnetic indices on the days of individual sessions. Call this Method 3.

Method 1 seems appropriate for spontaneous reports because there are no obvious control data for these psi events. We do not know, for example, about days when spontaneous events might be *suppressed* because no one has any reason to report such events. Method 2 and Method 3, however, may produce different results with the same experimental datasets. For example, the split-group method that we employed showed a significant difference in geomagnetic fluctuations between 'good' and 'poor' ganzfeld ranks, while a correlational analysis did not achieve significance.

Why does Method 2 show a result while Method 3 does not? One possibility is that the geomagnetic effect is both non-linear and non-monotonic, in which case Pearson or Spearman correlations are inappropriate statistics. Moreover, it is possible that the geomagnetic effect only manifests when psi occurs (psi-hitting or psi-missing); thus conducting a correlational analysis that, for example, retains ganzfeld ranks of 2 and 3, or Z scores near zero, may contribute so much noise to the dataset that even if the geomagnetic relationship *were* linear, a correlation might still not achieve significance. Therefore, because there are different ways of studying the geomagnetic effect, when we say that the effect was replicated in the present analysis, it is important to be clear that we mean that it has been replicated using Method 2.

Whatever the mechanisms underlying these observations, the possibility of any genuine geomagnetic relationship with psi performance is vitally important because it suggests that psi may be modulated by external factors. By keeping track of geomagnetic fluctuations or by building special enclosures in which magnetic fields can be manipulated at will, we may be able to make the outcomes of future psi studies more predictable. Of even greater importance, the geomagnetic effect may help to illuminate the mechanisms of psi itself.

Conclusion

This study partially replicated previous claims about a relationship between geomagnetism and psi performance in ganzfeld telepathy experiments. An unexpected finding was that the geomagnetic-psi relationship in a creative population was opposite to that observed in a normal population. The interaction of geophysical factors, special abilities and psi performance clearly warrants additional research.

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