Are phantasms fact or fantasy?
A preliminary investigation of apparitions evoked in the laboratory

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ABSTRACT

An important but unresolved question about apparitions is whether they are subjective fantasies or whether they reflect some form of objective reality. If apparitions are subjective, they may be best understood in normal psychological terms. If apparitions also involve some form of independent physical reality, the implications of this age-old phenomenon are more intriguing.

In a pilot experiment with seven participants, each of whom used mirror-gazing in a dimly lit room to induce a mild altered state of consciousness, all seven reported mild apparitional-type experiences, such as "feelings of presence." Assuming that apparitional experiences are related to shifts in consciousness, and that states of consciousness are reflected by physiological states, we monitored aspects of the local physical environment along with participants' physiology to see if subjective measures might be correlated with objective measures. Canonical correlations and neural network analyses indicated that the physiological measures were significantly related to the local environmental measures.

We conclude that under the right conditions, shifts in human consciousness may be correlated with both conventional and anomalous changes in the local physical environmental. This suggests two possibilities relevant to understanding apparitions: a) certain altered states of consciousness may cause powerful, objective, physical effects in the environment; and b) certain fluctuations in the environment may cause dramatic shifts in consciousness. The former suggests that apparitions may be objectively caused by mind-matter interaction phenomena; the latter suggests that apparitions may be subjective effects caused by external energies. Further studies are planned to help distinguish between these and other possibilities.

INTRODUCTION

Rise and Fall of the Ghost

For millennia, civilized peoples of the world believed that apparitions – ghosts of the dead – were objective, disembodied entities. Scholars attribute numerous reasons for this widespread belief, including the reasonable inference that if we have a spiritual, non-physical essence (i.e., a soul), then if the soul becomes disembodied it may decide to linger behind to enlighten or to pester the living.

Beyond the religious dogmas endorsing faith in disembodied souls, belief in authentic apparitions were (and still are) reinforced by personal experiences with phantasms. Such experiences are sometimes intentionally induced by fasting, drugs, drumming, sleep deprivation, and other techniques used throughout the ages. Apparitions also frequently occur in hypnogogic states (Ludwig, 1966), and in times of life-crises (Gauld, 1977).

About a century ago, accompanying the rise of the scientific method and organized skepticism, conventional Western wisdom began to reinterpret apparitions not as objective, disembodied spirits worthy of avoidance and fear, but as subjective fantasies and superstitious nonsense most often associated with the credulous and the unsophisticated (Spence, 1960; Radin, 1957). Besides the 20th century's general transition towards a materialistic worldview (Koestler & Smythies, 1969), one specific reason for the dissolution of the disembodied was undoubtedly the rise of modern psychology and psychotherapy, especially the growing appreciation of the power of the unconscious and recognition of non-ordinary states of consciousness.

Another reason was the observation that the behavior of apparitions was more suggestive of dreamlike events than objective, real-world events (Gauld, 1977). Apparitions tended to vanish suddenly, or pass through walls, or behave in stylistic or symbolic manners (Rhine, 1961). Sometimes apparitions would be seen to open a door and pass through it, whereas later the actual door would be found to be tightly locked, suggesting that at least part of the apparitional experience was purely hallucinatory (Bennett, 1949).

A "Distinctly Charitable Lurch"

However, one challenge to the view that apparitions are mere hallucinations is the fact that ghosts sometimes appear to sane, apparently well-adjusted, intelligent individuals. For example, in an article published in a professional journal, a psychologist describes a startling personal experience (Goldstein, 1976):

> While watching television I noticed human figures on the wall behind the television set. These images ... were transparent but in full color; they moved off the wall and wandered around the room, then disappeared. In every respect they resembled a Hollywood version of ghosts. This episode lasted about 1 hour. (pp. 423-424)

Another challenge to the subjective fantasy hypothesis is the observation that ghost stories and mediumistic phenomena occurred in the remotest corners of antiquity, when primitive concepts reigned, and yet they continue to haunt us today, even as we are immersed in a sophisticated

materialism. Therefore, it seems injudicious to discard any aspect of human experience that has persisted for millenia. Whatever the eventual explanation for these stories, it is worth noting that the feelings evoked by ghost stories are often accompanied by a remarkable numinous quality. As William James once put it,

> Although my judgment remains deliberately suspended, my feeling towards the way in which the phenomena of physical mediumship should be approached has received from ghost and disturbance-stories a distinctly charitable lurch. Science may keep saying: "such things are simply impossible"; yet, so long as the stories multiply in different lands, and so few are positively explained away, it is bad method to ignore them (James, 1978, p. 49).

A more serious challenge to the hypothesis of "mere subjective fantasy" were reports of apparitional experiences being shared by two and even three people (Hart & Hart, 1933; Hart, 1956; Lukianowicz, 1959). There are also long-term, site-specific cases of hauntings, where for centuries people claimed to have witnessed the same, distinct apparitions (Collins, 1948). And unlike hypnagogic imagery, which typically occurs with eyes closed as one drifts off to sleep, apparitions are commonly perceived with eyes open, and in states of consciousness that subjectively rival ordinary awareness. Thus, in some cases, hallucination does not appear to be an adequate explanation.

Before we continue, let us be more precise in defining what we mean by *apparition*. An apparition, from the Latin *apparers* (to appear), is an appearance which does not refer to any obvious, natural objective cause (Spence, 1960). The term "apparition" is broader than the more popular term, *ghost*, which implies a visual apparition of a deceased human being. Apparitions may also refer to deceased animals or other non-human spirits, and apparitions may be perceived in any sensory modality, such as auditory, tactile, or olfactory. Often, experiences of apparitions are also associated with reports of surges in bodily energy, electrostatic effects, and with rapid, localized cooling of the air (Roll, 1977).

Inducing Apparitions

One of the reasons that apparitions have remained a mystery, despite their relatively common occurrence, is the difficulty in systematically studying the apparitional experience. Modern techniques known to induce apparitional-type experiences, including hypnosis, sensory deprivation, flotation tanks, and psychoactive drugs, are often too difficult to employ because of federally-mandated controls on experiments involving human subjects. Another reason for the persistent mystery is the conventional psychological perspective, which assumes that apparitions are nothing but hallucinations and are therefore unworthy of serious study.

Fortunately, an innocuous but effective method exists for inducing apparitions. This method, suitable for use in laboratory settings, is simply gazing deeply into a reflective surface, such as a pool of water, a crystal ball, a polished metal surface, or a mirror. Systematic investigations of gazing deeply into reflective surfaces, also called *crystal-gazing* and *scrying*, began over a hundred years ago (e.g., Myers, 1892, 1903; Hyslop 1896-1897). In recent times, a mirror-gazing environment called the *psychomanteum*, based upon the ancient Greek oracles of the dead, has been studied by Roll (1975), Moody (1994), and others (e.g., Kelly & Locke, 1981). The psychomanteum is simply a

dark, quiet room with a comfortable chair and a mirror. The participant is asked to relax and look into the mirror, which is placed slightly above the person's level gaze in such a way that the reflection shows the wall above and behind the person's head.

The Psychomanteum Experience

After a few minutes to a half-hour in the psychomanteum, people typically report that the mirror gradually transforms into a window, swirling clouds appear in this window, and then intensely vivid visions are seen through the window. On occasion, visions from the "other side" of the window extend into the psychomanteum itself. These latter, three-dimensional visions, sometimes taking the form of humanoid apparitions, are often described as "hyper-real," that is, as more intensely real than the reality experienced under ordinary consciousness. An especially interesting aspect of visions induced by mirror-gazing is the autonomy of the image (Kelly & Locke, 1981). That is, these visions appear to be so utterly separate from the viewer that Myers (1903, V1, Ch 6) reports that occasionally an image can be examined in more detail under a magnifying glass.

Some people report that these apparitions are accompanied by electrostatic sensations (prickling skin, hair standing up), changes in ambient temperature (typically extreme cold), or illumination anomalies (sparkling lights, whole room diffused with bright light) (Moody & Perry, 1993). The experience of seeing an apparition can also be endowed with feelings of profound meaning, leading to significant transformations of personality. These dramatic effects are reminiscent of phenomena associated with peak experiences and mystical states (Ludwig, 1966).

In Roll's and Moody's experiments with the psychomanteum, about 50% of participants reported some form of experience with apparitions of departed spirits (Moody, 1994; Moody & Perry, 1993). Other researchers report more modest results, with estimates ranging between 1 and 3 percent of the population (Kelly & Locke, 1981) up to about 25 percent (e.g., Newbold, 1895). Of those who do experience full-blown apparitions, many are deeply affected and become utterly convinced that the apparitions are genuine, independent spirits. These experiences are reportedly beneficial in helping to resolve cases of chronic grief, and of course, from the therapeutic perspective it does not matter whether the apparitions are real or imaginary.

The Scientific Perspective

From the scientific perspective, a major unresolved question is whether these experiences are purely subjective (caused perhaps by a strong motivation to be reunited with a departed loved one) or if the apparition is an objective, independent entity. The answer to this question has important implications, for if such experiences are purely subjective, apparitions may be best understood in normal psychological, psychodynamic, or psychopathological terms, with no need to refer to the paranormal. On the other hand, if there are objective physical effects associated with apparitional experiences, interpretations become more complicated, suggesting a wide range of possible explanations. In order of increasing controversy, these include:

a) The *Neurological Hypothesis*, whereby exposure to certain environmental energies (or energies of certain frequencies) in the environment affects brain functioning, which evokes subjective hallucinations of apparitions, perhaps due to stimulation of neurological events such as temporal lobe microseizures (Persinger, 1985, 1987, 1989a, 1989b).

b) The *Perceptual Hypothesis*, whereby exposure to certain environmental energies affect brain functioning, which in turn allows us to perceive unusual events or objects, such as genuine ghosts, that cannot be perceived in ordinary states of awareness.

c) The *Telepathic Hypothesis*, whereby intense telepathic rapport affects brain functioning, causing the telepathic communication to be perceived as projected outside the body, sometimes in the form of the "sender's" image, as reported in cases of crisis telepathy (Gauld, 1977).

d) The *Psychokinetic Hypothesis*, whereby intense subjective experiences occasionally intrude upon the physical world, as postulated in poltergeist activity and by the concept of psychokinetic phenomena in general (Roll, 1977; Roney-Dougal, 1993).

e) The *Ghost Hypothesis*, whereby apparitions are genuine, independent entities that can be directly perceived or indirectly detected as anomalous energetic effects (Roll, 1994; Collins, 1948).

Motivations

The present study was a pilot effort exploring whether apparitions are "merely subjective" or associated with some form of measurable, objective reality. Specifically, we explored whether the mental state of a psychomanteum participant, as reflected by aspects of their physiology, might be related to objective changes in the local physical environment.

We decided to investigate physiological vs. physical correlations for three reasons: (a) anecdotal evidence from haunting investigations and studies of the electromagnetic properties of sacred sites suggest that exceptional physical and physiological states may be closely linked to reports of paranormal phenomena (Devereux, 1990; Radin, 1994), (b) reports of experiences in the psychomanteum suggest that physiological changes may be correlated with apparitional states (Roll, 1977; Moody, 1994), and (c) energetic anomalies are associated with certain altered states of consciousness (Green et al, 1991, Green et al, 1992). In realms (a) and (b), people report similar physical effects such as localized changes in room temperature, unusual lights, and anomalous electrical phenomena associated with sightings of apparitions. In realm (c), exceptional mental states have been associated with large-scale changes in local electrostatic fields.

METHOD

Beyond hints from the anecdotal lore, little is known about what specific physical effects may be expected to accompany apparitional experiences. As a result, this study was exploratory, and the

general approach was to cast a wide net and see what, if anything, might be captured. If interesting results were discovered in the pilot study, formal, follow-up experiments would be planned.

Equipment and Data Recording

Table 1 lists the equipment used in this experiment. The basic idea was to record as much of the local electromagnetic environment as feasible for a pilot study, and as much of the psychomanteum participant's physiology as possible without being psychologically or physically disruptive.

Table 1. List of equipment used in pilot experiment.

The low frequency end of the electromagnetic (EM) spectrum was monitored inside the psychomanteum by a Hewlett Packard EM spectrum analyzer and by two Applied Physics Systems fluxgate magnetometers. The visual and near-visual spectrum was monitored by an Electroscope light-amplified night vision camera, by longwave and shortwave infrared video cameras manufactured by FLIR Systems, and by a computer-monitored Geiger monitor made by Aware Electronics (sensitive to α, β, γ, and x-rays). The output of the video monitors was continuously recorded on video cassette tape.

Ambient temperature inside the psychomanteum was monitored by an Ertco-Hart computer-based thermometer with millidegree sensitivity. Fluctuations in electronic noise in the laboratory were monitored by a computer-based random number generator (obtained from Prof. Dick Bierman of the University of Amsterdam) which was programmed to periodically generate 100 truly random bits. The above three data sources were automatically recorded and time-stamped every 10 seconds.

Electric and magnetic fields inside the psychomanteum were monitored by a stand-alone, computer-based, battery-powered device called the EMDEX-C, from Electric Field Measurements, Inc.[1] We programmed this device to collect electric, magnetic (three-axis) and geomagnetic field (DC) samples once per second; the recorded data were uploaded to a computer after each psychomanteum session.

Psychophysiology was measured by a computer-based system (J&J Model I-410) which monitored up to 10 physiological variables between 10 and 1000 samples per second (according to the rate of change of each physiological variable). Data was recorded in 10-second samples (means and standard deviations) for each physiological variable.

The seven computer-based data streams collected per session (electric, magnetic, geomagnetic fields, ionizing radiation, random number generator, temperature, and psychophysiology) were manually fused into a combined database after all data for all sessions had been collected. Each sample in the various data streams was accompanied by a timestamp with 1/60th second accuracy to ensure that the

[1] We thank Dr. William Roll for loaning us this instrument for part of the present experiment.

fused dataset was correctly time-synchronized. An on-screen timestamp helped synchronize the video record to the computer database. We discuss the data formats in more detail later in this paper.

Participants

Seven individuals participated in this study. Table 2 lists the profession and age of each person and their approximate experience with apparitional / visionary states of consciousness. Individuals were recruited for this study based upon their interest and willingness to participate. Each person participated for one session which lasted a total of 2 to 3 hours.

Table 2. Participants in pilot experiment.

Laboratory Layout

Figure 1 shows the layout of the psychomanteum laboratory and the approximate placement of the equipment. The lab space was 12 feet square with a 12 foot ceiling; a psychomanteum chamber was built within this larger room, with dimensions of 6 by 8 feet and an 8 foot ceiling (the next section will describe the psychomanteum in more detail). To help create an isolated, undisturbed setting, the selected lab room was in a remote area of our building, the Harry Reid Center for Environmental Studies, University of Nevada. This second floor laboratory had no windows, the ceiling and two walls faced the outside (i.e., had no common walls with other rooms); the other two walls were adjacent to a closet and a rarely used hallway, and the lab was located above a storage room. The walls and ceiling of the lab were painted matte black to reduce light reflections. The lab itself was not electromagnetically shielded, but the psychomanteum chamber was, as explained below.

Figure 1. Top view of laboratory, psychomanteum chamber, and placement of equipment.

Psychomanteum

The walls of the psychomanteum chamber were constructed out of 2" x 4" wood studs, 5/8" wallboard, and R11 Fiberglas insulation (see Figure 2). To form a rudimentary EM shield inside the chamber, the floor, walls and ceiling were completely covered with aluminum insulation, and then checked throughout for electrical continuity. The insulation consisted of a sheet of 1/16th inch, 99% pure aluminum, a quarter-inch air spacing consisting of plastic bubblewrap, and then another sheet of 1/16th inch aluminum. The walls and ceiling of the chamber were covered by black velveteen fabric to create a dark, featureless interior, and the floor was covered by a black carpet.

Figure 2. Side view of psychomanteum, placement of equipment, and closeup of wall construction.

A reclining chair and a wall mirror (2 x 3 feet) were brought inside the chamber and positioned for optimum comfort and viewing angles. Because the chamber was virtually a darkroom, a 25 watt incandescent lamp was placed behind the reclining chair, facing down, to provide enough illumination for the participant to see the mirror. A dimmer control for this lamp was operated outside the

chamber to adjust illumination levels. The Geiger counter, millidegree temperature probe, EM antenna, and physiological electrodes were fed through three 1-inch portholes in the side of one wall. These holes were then tightly sealed with aluminum foil to maintain continuous electrical conductivity inside the chamber. The psychomanteum shielding was connected to the EM spectrum analyzer's ground.

To provide windows into the psychomanteum for the infrared and low-light cameras, three 4 -inch-square portholes were cut into the walls, two on the "back" wall, behind the reclining chair, and one underneath the mirror. These holes were covered with aluminum mesh screen with 1 mm spacing, stapled securely to the solid aluminum sheeting on the walls with conductive staples, and checked for electrical conductivity. When the cameras were in place, opaque acoustic foam was wedged between the lenses and the sides of the porthole to reduce outside light and sound from intruding into the psychomanteum.

As a quick check on the psychomanteum's EM shielding, a battery-powered AM radio was tuned to a strong radio station, and as it played it was slowly moved from outside to inside the chamber. The volume of the signal dropped noticeably as soon as the radio passed through the psychomanteum doorway, and the signal disappeared entirely once the radio was inside. Later, in a more formal check of the shielding, the EM spectrum analyzer was used to measure EM power from 30 Hz to 6 GHz inside the sealed chamber; the results showed that the spectrum was essentially flat across this range, with the peak amplitude of all frequencies averaging around 75 µvolts. The strongest intermittent signal recorded inside the chamber peaked at approximately 1 millivolt. This signal was most likely caused by local cellular phone transmissions, as the peak centered on a frequency often used by cellular phones (i.e., 831 MHz).

Experimental Procedure

Each participant was asked prior to their session to think about a departed loved one that they wished to have an apparitional "reunion" with. When they arrived for the session, they met our colleague, Diane Arcangel, a hospice chaplain and experienced psychomanteum facilitator. Arcangel spent between 30 minutes and 2 hours with the participant, talking about their feelings and their memories of the deceased person, and she explained the psychomanteum purpose and procedures.

Moody and Perry (1993) explain the typical preparatory session as follows:

> We discussed in detail the person who had died and the relationship that had existed between the two of them. We explored such areas as the type of person the deceased had been, his or her appearance, habits – virtually every aspect of personality.... [After the preparatory session] the subject was then told to gaze deeply into the mirror and to relax, clearing his or her mind of everything but thoughts of the deceased person. The subject could stay in the chamber as long as he wanted, but was asked not to wear a watch so that he would not be tempted to glance at the time. (p. 85-86)

When Arcangel felt that the participant was ready, she escorted him or her into the laboratory. We attached the electroencephalograph (EEG), electrodermal activity (EDA) and photoplethysmograph (PPG) electrodes, then ushered the participant into the psychomanteum. Once inside, we checked the

physiology monitor to make sure the electrodes were attached properly, then we asked Arcangel to say a few words to the participant before the session began. She asked them to gaze into the mirror, relax, and have fun. When she left the psychomanteum, we began recording all videos and computer-based monitors. Because of time restrictions and limited availability of some of the equipment, each participant ran one session in the psychomanteum. Each session lasted at least 45 minutes; a few sessions lasted more than an hour.

RESULTS

Subjective Experiences

After each session, we spoke with each participant about their experiences. As shown in Table 3, four of the seven participants (referred to as GA, KG, LB, RM) felt the presence of a deceased individual, at least briefly; one person perceived an apparition of an animal (MC); and three noticed changes in illumination or bodily energy (AR, MC, RP). Overall, we would classify these sessions as mild apparitional experiences at best, as no one reported a sustained, intense visionary experience. Because only rather calm experiences were reported, we were initially doubtful that analyses of the recorded physical and physiological data would reveal anything interesting.

Table 3. Participants' experience in the psychomanteum.

Computer-Monitored Data

Table 4 shows a representative sample of the raw physical data for one participant. Each number represents the results of a measurement taken inside the psychomanteum during a 10-second sample period ending at the time indicated. The variable *temp* was the instantaneous (i.e., not an average) temperature, accurate to one millidegree Fahrenheit; *RNG* was the sum of truly random bits generated out of 100 bits generated at the end of each sample period; *rad* was the number of ionizing radiation particles detected by the Geiger counter during a sample period; *geomag* was an average of 10, one-second measurements of the (DC) geomagnetic field strength along one axis[2], in milliGauss; *electric* was an average of 10, one-second measurements of AC (0 - 300 Hz) electric field strength, in millivolts; and *magnetic* was an average of 10, one-second RMS measurements of the combined three-axis AC (0 - 300 Hz) magnetic field strength, in milliGauss.

Table 4. Example of raw physical data.

Table 5 shows a portion of the raw physiological data for one participant. The variables *beta*, *alpha* and *theta* were measures of EEG power ($\mu volt^2$) at frequencies 12 – 18 Hz (beta), 8 – 12 Hz (alpha), and 4 – 8 Hz (theta). EEG was sampled 128 times per second, with 1 μvolt sensitivity over the range ±100 μvolts. *skin temp* was the skin temperature at the tip of the index finger of the right

[2] This feature is used to orient the device relative to the Earth's magnetic field when used in field work.

hand; it was sampled 73 times per second, with 0.02° sensitivity, Fahrenheit. *EDA* was electrodermal activity, measured between the index and second finger of the right hand, sampled 73 times per second within the range 0.5 to 100 μmhos with .02 μmho sensitivity. *HR* was heart rate, measured by a photoplethysmograph (PPG) on the third finger of the right hand, and *BVP* was blood volume pulse, also measured by the photoplethysmograph. The PPG signal was sampled 10 times per second, with DC drift filtered out.

Table 5. Example of raw physiological data.

Data Preparation

We began by postulating that during non-ordinary states of consciousness when people report seeing apparitions there are significant correlations between physical and physiological variables. However, because (a) in this pilot design we had no way of knowing *a priori* when an apparitional state would begin, (b) we did not want to disrupt the participant (and thereby pull them out of non-ordinary states) by asking them to report their internal states, and (c) we wanted to avoid selecting arbitrary segments of the data, we decided to use the entire dataset for each participant. This is a conservative approach because we presume that the recorded sessions consisted largely of ordinary states of consciousness.

First we transformed the absolute temperature measurements inside the psychomanteum into temperature *difference* measurements (*Dtemp*, the difference between room temperature samples *n* and *n-1*,). We used temperature difference measures to reduce first-order autocorrelations due to temperature drift. Then we transformed the output of the random number generator into *z* (standard normal deviate) scores as $z = (x - 50)/5$, where *x* was the raw output of the RNG.

Next, we normalized the variables by transformed each sample into a standard normal deviate *z* score using the equation $z_i = (x_i - u)/s$, where x_i = sample i of a given variable array, μ = mean of that variable array, and σ = standard deviation of the array. For the physiological measures, we took the additional precaution of performing a 5% trim of each variable before performing the *z* transform to filter outliers likely due to movement artifacts.

Cross-Correlation Analysis

Without predicting the direction of correlations among the physical and physiological variables, we calculated all cross-correlations using the z-transformed variables as explained above, calculated how many were significant at $p < .05$, 2-tailed, and then compared the observed number of significant correlations against the chance expected number.

Because of several episodes of anomalous equipment failure and having to return some borrowed equipment after the first four sessions, we were not able to record the identical number of variables or samples for each participant. The final sample count, as listed in Table 6, represents the largest block of data successfully recorded for all available variables given the available equipment. Table 6 also shows which variables were successfully recorded, with reasons for the missing data. The table shows that a total of 195 correlations were calculated.

Table 6. Number of physical vs. physiological correlations calculated,

correlation sample sizes, missing variables and comments.

Table 7 shows the results of the resulting cross-correlations, tabulated per participant by physical measure. Out of 195 correlations, 9.75 are expected by chance at the $p < .05$, two-tail level, assuming that the variables are truly independent of each other. Given that some were clearly not independent, e.g., the physiological variables were strongly intercorrelated, instead of 9 significant correlations, 58 were observed.

Table 7. Count of cross-correlations significant at p < .05, two-tail.

Examination by physical measure (see Table 8) indicates that most of the significant cross-correlations were due to the physical variable *Dtemp* (change in ambient temperature). One explanation for these correlations is that the temperature rose during the initial few minutes that the experimenter, facilitator, and participant were all in the psychomanteum together. When the session began, only the participant was present, so the temperature began to drop. This downward drift probably correlated with a general physiological calming as the participant relaxed. Thus, at least some of the significant *Dtemp* vs. physiological correlations may have been artifacts of a common downwards drift.

Table 8. Physical vs. physiological cross-correlations significant at p < .05, two-tail.

After excluding all *Dtemp* cross-correlations, 152 correlations remained, of which 7.6 were expected to be significant by chance. Because 24 were observed among the remaining physical variables, there is suggestive evidence that some of the physical vs. physiological correlations reflect genuine relationships.

Canonical Correlation

A more appropriate method for examining the relationships between the physical and physiological variables is to determine a single correlation between the two *sets* of variables. The statistical test in this case is canonical correlation. For each participant, a canonical correlation was determined between the set of physical variables, excluding *Dtemp* for reasons noted above, and the entire set of available physiological variables.

Results, shown in Table 9, indicate significant relationships among the physical and physiological variables for three participants. The degrees of freedom shown in Table 9 are determined by the product of the number of variables compared in the two sets; these figures are the same as those listed in Table 6. The combined results for all seven participants results in $p = 10^{-16}$, indicating that as a group, there is little doubt that the physical and physiological factors were related.

Table 9. Results of canonical correlations and significance of the correlations.

Neural network predictions

Claiming that there are genuine relationships among the physical and physiological variables is equivalent to claiming that some combination of each participant's physiological data can be used to predict his or her physical data. If the claim is true, it should be possible to build a model of the supposed relationship and then test the model.

We created such a model using an artificial neural network to predict physical measurements associated with a specific individual based upon his or her physiological data (Radin, 1989, 1993b). The advantage of using neural networks over standard linear (or nonlinear) regression techniques is that we did not have to specify in advance the nature of the model. Instead, the data was allowed to determine the model.

A standard back-propagation network[3] was employed (Lawrence & Lawrence, 1992). For each participant, a dataset of *z*-transformed physiological and physical variables was split into training and testing subsets; 90% of the full dataset was used to train the network and 10% was withheld to test the network. Each network was trained a minimum of 1,000 times on the training dataset, then tested on the test dataset. The number of "hidden nodes" used for each net was twice the number of the input nodes (i.e., physiological variables), plus one.

To determine how well a neural network learned, we created a single correlation between all predicted outputs (i.e., physical variables) and all actual outputs in the test dataset. For example, from Table 6, we see that AR's dataset consisted of 260 samples of 3 physical and 7 physiological variables. In this case, 90% of the database resulted in 234 training samples and 26 testing samples, as shown in Table 11. Combining 26 test outputs times 3 predicted variables produced a total of 78 samples, leading to a correlation with 76 degrees of freedom. We predicted we predicted a positive correlation between the observed vs. predicted outputs

Table 10. Results of neural network tests.

Table 11 shows that all 7 neural network tests resulted in positive correlations, of which 5 were statistically significant at $p < .05$, two-tailed. With any modelling effort, we would expect that as we increase the number of predictors, the better the resulting correlations should be. Thus, referring to Table 6, we would expect that the largest correlations would be observed for participants AR, KG, and LB, each of whom had seven predictors attempting to predict three outputs, and the smallest correlation for RP, who had two predictors attempting to predict six outputs. This is what we observe

[3] *BrainMaker Professional*, version 3.1, from California Scientific Software, was used for these analyses.

in Table 11. The only anomaly is MC, who according to our reasoning should have had a larger predicted vs. actual correlation.

DISCUSSION

Summary of pilot study

In a controlled mirror-gazing environment, seven participants attempted to evoke apparitions while various monitors recorded physical and physiological variables. All seven participants reported experiences that we classified as mild apparitional states, but the monitoring equipment did not detect the presence of anything sufficiently anomalous that might be interpreted as unequivocal evidence for objective apparitions. Correlational analyses of the physical and physiological data indicated the presence of statistically significant relationships between individuals' physiology and local physical measures, and a neural network test again indicated the presence of significant relationships between the physiological and physical measures.

If mild apparitional states are associated with genuine physical/physiological correlations, it raises the plausibility that more intense mental experiences may cause the sort of large-scale physical effects which are associated with traditional apparitional experiences. Ignoring the fact that correlation does not imply causation, this may mean that the "arrow of causation" associated with apparitional experiences goes from the mental (as we measured in the present study by physiological parameters) to the physical. This in turn implies that apparitions may be "caused" by human psychokinetic abilities (Roll, 1994). This speculation has some support, especially in the experimental and anecdotal psi literature (e.g., Roll, 1977; Radin & Nelson, 1989).

What are spirits made of?

When the psychiatrist, Carl Jung, spoke to the Society for Psychical Research in 1919 on "The psychological foundations of belief in spirits," he regarded ghosts as exteriorized (i.e., psychologically projected) unconscious complexes. He wrote:

> I am convinced that we are dealing with exteriorizations. I have, for instance, observed several instances of unconscious complexes; I have also observed a series of parapsychic phenomena. However, in all this I cannot see any proof for the actual existence of spirits, but must regard this area of phenomena for the time being as another segment of psychology (Jaffé, 1978, p. 91).

Given the suggestive results of our pilot test, we believe that apparitions may be more complicated than (comparatively) simple psychological phenomena. Jung, later in life, arrived at the same conclusion. When his above paper on "belief in spirits" was re-published in an anthology almost 40 years later (1947), he added the following footnote:

> After collecting psychological experiences from many people and many countries for fifty years, I no longer feel as certain as I did in 1919 .... To put it bluntly, I doubt whether an exclusively psychological approach can do justice to the phenomena in question. Not only the findings of parapsychology, but my own theoretical reflections ... have led me to certain postulates which touch on the realm of nuclear physics and the conception of the space-time continuum. This opens up the whole question of the trans-psychic reality immediately underlying the psyche (Jaffé, 1978, p. 92).

A feedback system and a metaphor

Imagine the mind/body system as a cork, bobbing about in an ocean of environmental influences. Research on environmental effects on behavior indicates that as temperature, humidity, and barometric pressure change, our body and behavior change along with it (Persinger & Levesque, 1983; Playfair & Hill, 1978). Evidence from psychoneuroimmunology and placebo research suggests that to a surprisingly strong degree, where our mind goes, so goes our body (Gravitz, 1981; Gazzaniga, 1988; Cohen, 1985, Cousins, 1989). And evidence from psi research suggests that sometimes when our mind "moves," the physical environment around us responds accordingly (Radin, 1992, 1993a).

What emerges from this research is a complex feedback cycle: The environment affects the body and mind, the mind affects the body and the environment, and the body affects the mind and the environment. Such complex feedback cycles are not commonly observed in experiments because they are not generally looked for; in the present experiment we seem to have detected it because we were specifically interested in such interactions.

Given this postulated feedback cycle, we would expect that under intense environmental conditions, or intense mental states, or intense bodily conditions, we would observe fairly large-scale anomalies in the mind/body/environment system. For example, during violent weather conditions, such as during a ferocious lightning storm, we might predict the appearance of unusual mental or bodily effects. These may manifest as increases in indices of violence, abnormal behavior, illness, or even in mass sightings of the Virgin Mary or UFOs. Likewise, intense mental states, such as epilepsy, might be associated with unusual bodily phenomena or strange physical effects in the local environment, such as poltergeist activity, the appearance of stigmata, or spontaneous remission of illness. And intense bodily changes, such as those that sometimes occur during yogic breathing techniques or deep-tissue bodywork, we might predict the appearance of strange mental or physical phenomena. This includes the appearance of apparitions, anomalous lights, or failure of electrical equipment (Gauld, 1977).

Assuming the existence of complex interactions among mind, body and environment, we therefore suspect that *some forms* of apparitions may be not purely subjective (as in hallucinations) nor purely objective (as in disembodied entities). Instead, we postulate that some apparitions are – metaphorically speaking – short-term vortexes caused by disturbances in a three-way equilibrium. When the disturbed state is allowed to rebalance, the apparition dissolves back from whence it came.

The metaphor of a vortex seems appropriate, because a vortex is a powerful, "living" entity created by a disturbance in the ground medium itself – whirlpools, tornadoes, and black holes being common examples. The vortex is sustained until the energy that formed it dissipates; such entities have no existence by themselves. In a similar manner, we postulate that an apparition may have no completely independent existence, but it is "alive" in the sense that once it is created by a human being's energy, it may enjoy a certain, short-lived independence until the energy that sustains it dissipates. At that point, the apparition once again fades into the background from whence it came. This poignant, ghostly existence is reiminscent of our own lives. We arise from a ground-state, we live for a short time, and then we return to the ground-state.

Critique

What is new?

At this point, some readers may be thinking that this study has merely rediscovered what psychophysics has taught for years: The human body is an electrochemical dynamo, constantly broadcasting electromagnetic and magnetic signals. While most of these signals are exceptionally weak outside the body, we know they can be detected given a well shielded environment and sufficiently sensitive instruments. We also know that the human body responds to changes in environmental energies. Thus, by confirming what is known by psychophysics, we reinforce the implications of the tri-part model mentioned above, namely: If the mind, body and environment are in fact linked, and weak effects in one system are reflected in the others, then it is reasonable to expect that strong effects will also be reflected.

However, the data also suggests something slightly unexpected. For each participant, we examined the correlation between the set of physiological variables and the z score from the truly random number generator (RNG). Under the null hypothesis, the correlation should be zero because the RNG was designed to rule out all known influences, and it was located outside the electromagnetically shielded room. Nevertheless, Table 12 shows that one person obtained an independently significant correlation, and the combined results are nearly significant, $p = .07$ (two-tailed). While there is substantial evidence suggesting that anomalous correlations with RNGs are genuinely related to conscious intention (e.g., Radin & Nelson, 1989), the implication here is that shifts in consciousness may "disturb" *something* in the local environment that can be detected by the presence of RNG. This in turn provides some support for the proposed mind $\rightarrow$ environment link in the tri-part model discussed above. How this anomaly may be specifically related to the apparitional experience remains to be seen in future experiments

Table 11. Correlations between physiology and z score.

Methodology

Because this study was exploratory, detailed analyses and methodological procedures were not prespecified in advance. As a result, in the course of the experiment a number of important methodological issues became apparent. For example,

a) The pilot study did not explicitly include control periods. That is, we did not include a period of time during each session in which participants were asked to relax in the psychomanteum without doing anything. Control data would be useful in determining whether the psychomanteum experience is different from simply relaxing with eyes open. One reason we did not employ a control session is because the instructions for a psychomanteum session closely resemble instructions assigned to typical control periods: Just relax and gaze into the mirror. There are no instructions to attempt to see an apparition, nor are any explicit induction procedures used. Thus, given the simple procedure used in the psychomanteum, we were not sure how to add a control period without creating a control that was more "manipulated" than the experimental session itself.

b) The psychomanteum was intentionally isolated to create a quiet and comfortable laboratory environment. We aimed for an unobtrusive experiment by hiding the monitoring equipment as much as possible. We were successful in achieving an isolated laboratory space, but unfortunately the psychomanteum was much noisier than we would have liked due to the circulating pumps used to cool the video sensors in the infrared cameras. Furthermore, because of limitations in laboratory space, participants were required to walk through a virtual beehive of electronic monitors and recording instruments to enter the psychomanteum, making it difficult to maintain a calm environment.

c) We had no way of knowing when apparitional states would begin, other than listening in on the audio tape monitor and watching the participant on the infrared cameras. We thought it might disrupt the desired state of consciousness (which we have referred to as an apparitional state) to ask participants to report their experiences aloud. In addition, by asking participants to speak aloud, movement artifacts would be introduced into the physiological recordings. One approach to solving the problem of how to mark when something interesting happens is to give the participant a switch to press. However, participants may not remember *why* they marked a given period as important, and even if we asked them to speak aloud, there is no guarantee that during full-blown apparitional states they *could* speak, or that they would remember to speak.

d) Multiple equipment monitors were used to independently collect data. We reasoned that if one monitor failed for either normal (e.g., a power spike or hardware error) or anomalous reasons, we would still be able to collect some data. However, using multiple monitors also meant that data streams had to be fused after each session to reconstruct the common time-sequence. In addition, video and audio data were not synchronized with the computer-monitored data other than by putting a time-stamp on the video record. We plan to overcome this problem in our next series of experiment by using a network to link the various computer-based monitors together, and by adding time-codes to the video records.

e) We had no way of knowing how long an apparitional state would last. Would a ghost appear in a tenth of a second flash, or would anomalous energetic effects persist for 20 minutes? We simply guessed that the 10-second averages we settled upon would offer sufficiently fine resolution to capture interesting energetic events.

Recommendations for Further Study

We plan to enhance the psychomanteum laboratory for future tests in the following ways:

a) Use questionnaires to look for personality, experience, and interest commonalities among successful participants.

b) Investigate the possibility of using non-contact sensors and electrodes to create a less intrusive lab environment.

c) Run longer sessions, a minimum of 90 minutes in the psychomanteum and at least a 30 minute post-session debriefing.

d) Develop a way for the experimenter and the participant to mark interesting events that occur during the psychomanteum session.

e) Use time-stamped audio/video records linked to computers.

f) Use automated digital audio/video analysis methods to scan the video records frame-by-frame for anomalies. A blink of the eye or a momentary lapse of attention can easily cause a human analyzer to miss a single anomalous event if he or she is attempting to manually analyze a lengthy video records.

g) Experiment with gold anodized, front-surface mirrors rather than common float-glass mirrors. This recommendation originated from studying the type of surface required to see reflected infrared images. We discovered that a back-surface glass mirror, i.e., the sort of mirror commonly available in retail stores does not reflect infrared images because the glass absorbs infrared radiation.

h) Use a natural, relaxed setting for the laboratory. As Moody recommends (1993, p. 166 - 172), the setting accompanying the psychomanteum experience is important. Ideally, participants should be able to walk in comfort in the woods or along a beach. The air should be refreshing, the scenery should be inspiring, and the participant should feel safe enough to allow an altered state of consciousness to emerge even before entering the psychomanteum. Beautiful and provocative art should be close at hand to stimulate the emotions; the intellect should also be stimulated with interesting books and curious objects and instruments.

CONCLUSION

This report describes a pilot study designed to experimentally investigate the nature of facilitated apparitions. Aspects of the local physical environment and physiological parameters were monitored as volunteers gazed into a mirror in a dimly lit room. The investigation, involving seven participants, did not result in experiences of sustained, lifelike apparitions, but all seven people reported mild apparitional experiences, including feeling the presence of deceased persons and animals, and changes in energy and illumination levels.

Analysis of the physical and physiological data revealed statistically significant relationships between the physical and physiological measures. This was interpreted as suggesting that the mind, body and environment are closely coupled and probably interact and influence each other more than commonly supposed. We speculate that because of this coupling, intense mental states may be associated with dramatic physical changes in the local environment. These could possibly give rise to the reported energetic phenomena associated with classic apparitional phenomena, including changes in temperature, anomalous lights, and appearance of humanoid and animal shapes.

Whether future studies can detect such large-scale effects during vivid apparitional experiences remains to be seen. Finally, if asked to respond to the question posed by the title of this paper, "Are phantasms fact or fantasy?", we would reply that we still do not know, but as is often the case when exploring poorly understood realms, the answer appears to be more complicated than we had originally thought.

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Figures and Tables

Equipment	*Purpose*	*Comment*
FLIR Prism SP	high resolution infrared video	spectral range 3.6 to 5 microns, 0.1° C sensitivity
FLIR IQ-810	high resolution infrared video	spectral range 8 to 12 microns, 0.06 ° C sensitivity
Astroscope 9300VL	night vision light amplifier	visual range, with 10^{-4} lux sensitivity
Canon L1	video camcorder	high resolution camera used with Astroscope
Applied Physics Systems 534	3-axis fluxgate magnetometers (2)	1 μGauss sensitivity, DC - 300 Hz response
Hewlett Packard 54520A	500 MHz digital oscilloscope	used to display magnetometer outputs
Hewlett Packard 8561E	spectrum analyzer	continuously scanned electromagnetic spectrum, 30 Hz - 6 GHz
JVC GR-AX75	VHS-C camcorder	recorded display of EM signal analyzer
Sony WM-D6C	audio cassette recorder	recorded sounds inside psychomanteum
RNG	random number generator	truly random, based on electronic noise
EFM EMDEX-C	battery-powered electromagnetic field monitor	AC magnetic (0 - 300 Hz), DC magnetic, AC electric (0 - 300 Hz)
Ertco-Hart 850	temperature monitor	computer-based, millidegree sensitivity
Aware RM-60	Geiger counter	computer-based, sensitive to α, β, γ and x-rays
Panasonic WJ-450	video quad system	combined infrared, light-amplified videos, and normal video signals into one display
Panasonic CT-2084	20" video monitor	used to display quad video signal
RCA VR 323	video cassette recorder	usd to record combined video signals
Computers	controlled computer-based equipment	two 80486DX2 computers, one 80286 computer; custom-designed software
J&J I-410	computer-based physiological monitoring system	electrodermal (EDA), blood volume pulse (BVP), heart rate (HR), skin temperature (temp), electroencephalograph power (beta, alpha & theta)

Table 1. List of equipment used in pilot experiment.

ID	*profession*	*age*	*altered states experience*
LB	mother of two small children	28	little
AR	mother of two pre-teen children	43	some
RP	male professional bodyworker, yoga teacher	24	moderate
KG	female yoga teacher	55	moderate
MC	female psychotherapist, Holotropic Breathwork facilitator	43	extensive
GA	male psychic, medium, author	42	extensive
RM	male psychiatrist, philosopher, author	50	extensive

Table 2. Participants in pilot experiment.

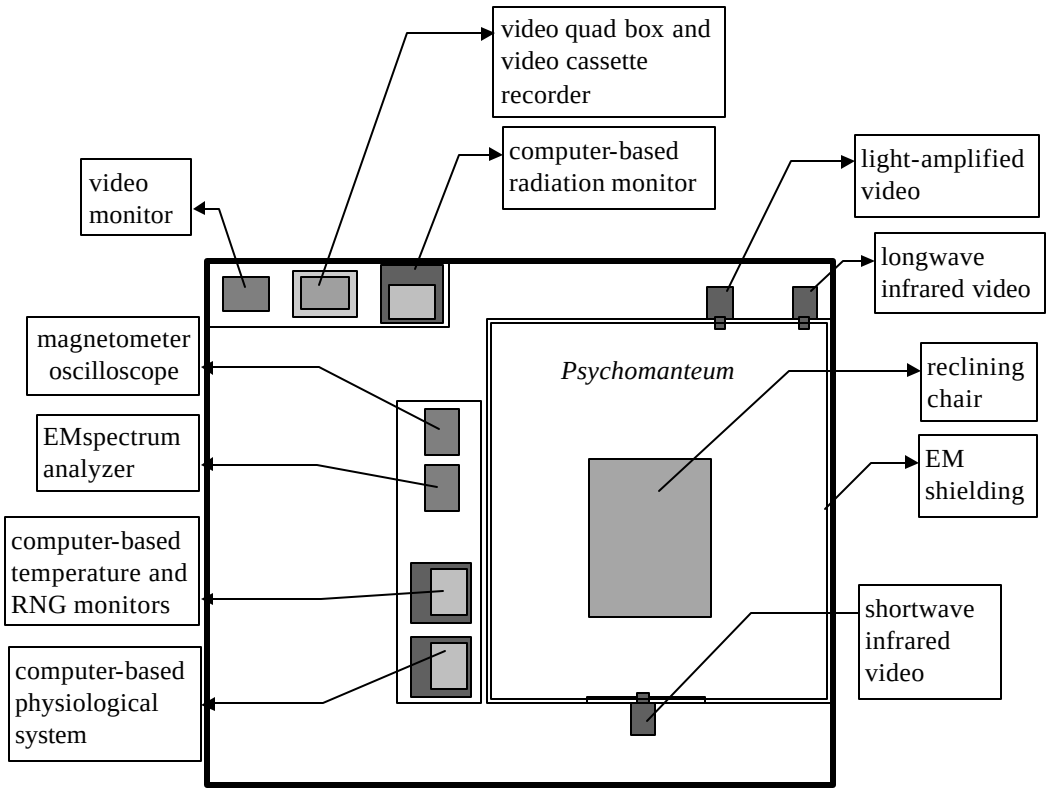

Figure 1. Top view of laboratory, psychomanteum chamber, and placement of equipment.

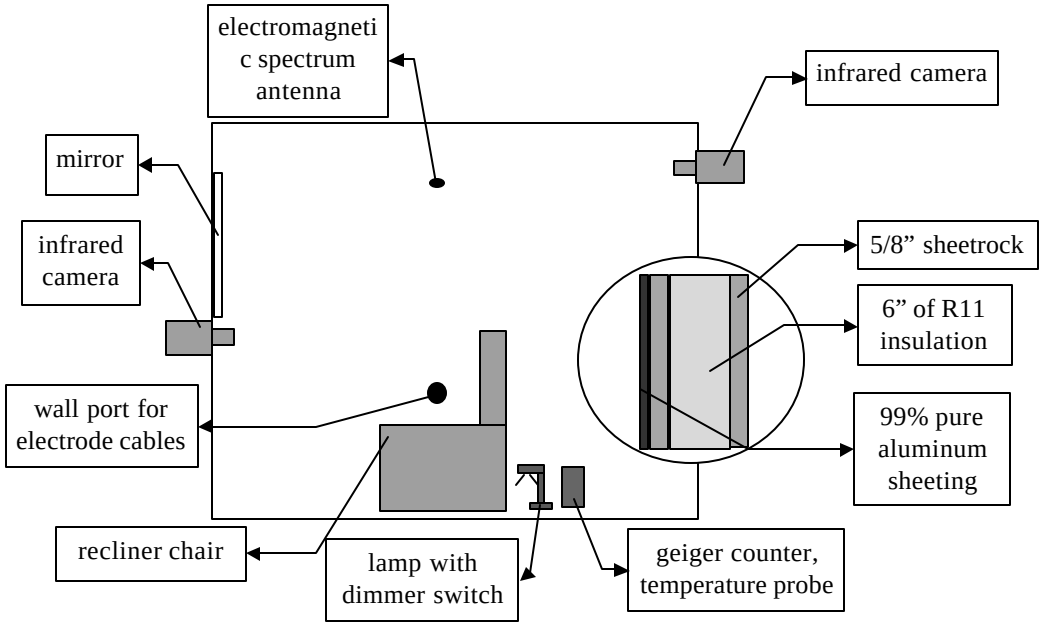

Figure 2. Side view of psychomanteum, placement of equipment, and closeup of wall construction.

Participant	*Experience*
AR	noticed fluctuations in illumination levels
GA	felt the presence of deceased individuals
KG	felt the presence of angelic spirits
LB	felt the presence of a deceased loved one
MC	felt surges of energy, saw brief vivid apparition of animals
RM	felt presence of deceased loved one, perceived apparitional outline
RP	felt sensations of energy flow

Table 3. Participants' psychomanteum experience.

Sample	*time*	*temp*	*RNG*	*rad*	*geomag*	*electric*	*magnetic*
1	12:40:09	71.473	61	2	4.84	0.0310	0.0067
2	12:40:19	71.479	52	2	5.72	0.0290	0.0077
3	12:40:29	71.487	44	3	6.60	0.0320	0.0075
4	12:40:39	71.495	58	4	5.72	0.0290	0.0069
5	12:40:49	71.503	47	3	8.80	0.0300	0.0074

Table 4. Example of raw physical data.

Sample	*time*	*beta*	*alpha*	*theta*	*skin temp*	*EDA*	*HR*	*BVP*
1	12:40:09	5.20	6.30	9.78	90.82	1.60	90.38	8.16
2	12:40:19	6.33	7.24	12.17	90.79	1.62	86.83	7.55
3	12:40:29	5.80	11.20	10.45	90.86	1.81	89.39	4.60
4	12:40:39	6.30	9.34	9.76	90.93	1.80	86.49	5.20
5	12:40:49	6.42	8.35	10.08	90.89	1.67	86.37	4.80

Table 5. Example of raw physiological data.

ID	*physical x physiological*	*r's*	*samples*	*missing variables*	*comment*
MC	6 x 7	42	120	none	lost physiological data for first half of session due to anomalous computer failure
RM	6 x 7	42	170	none	lost some ambient temperature data due to anomalous temperature monitor failure
GA	6 x 6	36	260	skin temp	skin temperature electrode lost contact
RP	6 x 2	12	240	alpha, beta, theta,HR,BVP	EEG, HR, and BVP electrodes lost contact near beginning of session
AR	3 x 7	21	260	electric, magnetic, geomag	data recorded fine; EM monitor unavailable for this session
KG	3 x 7	21	180	electric, magnetic, geomag	some physiology data lost due to procedural oversight; EM monitor unavailable
LB	3 x 7	21	130	electric, magnetic, geomag	some physiology data lost due to procedural oversight; EM monitor unavailable

Table 6. Number of physical vs. physiological correlations calculated, correlation sample sizes, missing variables and comments on each session.

ID	*RNG*	*radiation*	*Dtemp*	*magnetic*	*electric*	*geomag*
GA	1	3	4	0	2	1
MC	0	1	4	0	3	0
RP	0	1	2	0	1	1
RM	0	0	7	5	2	1
AR	0	0	6	n/a	n/a	n/a
KG	2	0	5	n/a	n/a	n/a
LB	0	0	6	n/a	n/a	n/a

Table 7. Count of cross-correlations significant at p < .05, two-tail.

Variable	*RNG*	*radiation*	*Dtemp*	*magnetic*	*electric*	*geomag*
beta	0	1	6	0	1	0
Alpha	1	1	4	1	0	0
Theta	0	1	5	1	0	1
Temp	1	2	4	1	2	1
eda	1	0	6	1	2	2
hr	0	0	4	0	0	0
bvp	0	0	5	1	2	0
SUM	3	5	34	5	7	4

Table 8. Physical vs. physiological cross-correlations significant at p < .05, two-tail.

Participant	*R*	*Chi²*	*df*	*p*
	0.212	15.6	21	0.79
AR				
GA	0.545	110.3	36	10^{-9}
KG	0.305	20.7	21	0.48
LB	0.291	16.1	21	0.76
MC	0.430	54.0	42	0.10
RM	0.539	110.9	42	10^{-8}
RP	0.495	72.0	12	10^{-10}
Combined		399.6	195	10^{-16}

Table 9. Canonical correlations, not including variable, Dtemp.

ID	*Total samples*	*Training samples*	*Testing samples*	*Predicted variables*	*r*	*df*	*p(r)*
MC	120	108	12	7	0.061	82	0.580
RM	170	153	17	6	0.446	100	.000003
GA	260	234	26	6	0.209	154	0.009
RP	240	216	24	6	0.039	142	0.644
AR	260	234	26	3	0.538	76	.0000004
KG	180	162	18	3	0.472	52	0.0003
LB	130	117	13	3	0.567	37	0.0002

Table 10. Neural network training test results.

Participant	*R*	*Chi²*	*df*	*p*
AR	0.178	8.393	7	0.299
GA	0.150	5.853	6	0.440
KG	0.288	14.96	7	0.036
LB	0.254	8.530	7	0.288
MC	0.224	6.937	7	0.435
RM	0.241	10.062	7	0.185
RP	0.103	2.523	2	0.283
Combined		57.255	43	0.072

Table 11. Correlations between random number generator Z score and physiology.

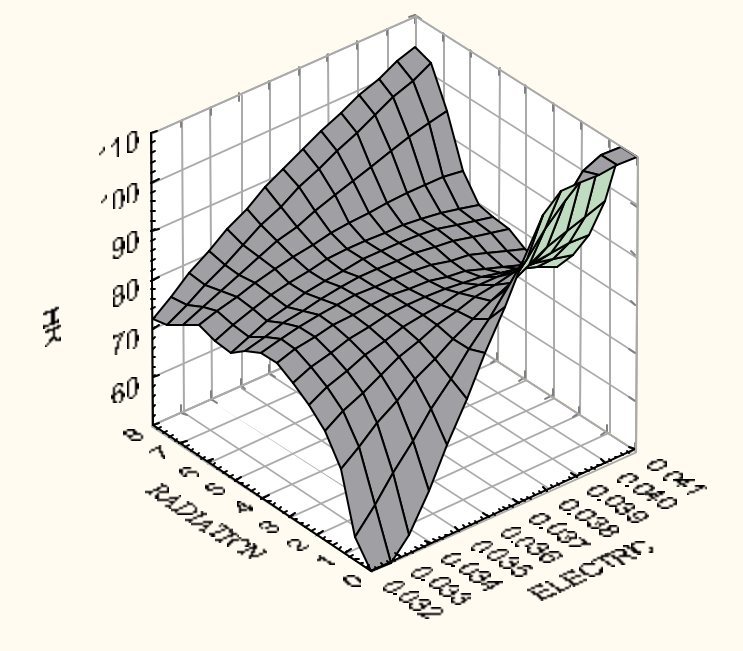

Figure 3. Interactions among three variables for participant MC.