Theme Issue: Experimental NeuroTheology

The Harribance Effect as Pervasive Out-of-Body Experiences

NeuroQuantal Evidence with More Precise Measurements

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Abstract

A historical summary is presented of the published and unpublished measurements of the physical changes associated with Sean Harribance while he accurately discerned recondite information about others. Reports of his subjective experiences as well as the quantitative electroencephalographic (QEEG), sLORETA, SPECT, and neuropsychological data support the occurrence of measurable and specific out-of-body like states that are strongly correlated with independent ratings of his accuracy of people he does not know but with whom he is spatially proximal. Coherence between theta (Schumann resonance) and gamma activity within the right temporoparietal and frontal regions and his left temporal region is congruent with information acquired by his right hemisphere and interpreted by the left. The quantitative values of the emissions of photons and alterations in the intensity of the geomagnetic field (both equivalent to energies of about 10^{-11} J/s or 10 pW/m^2) around his head during this state were congruent with the estimated numbers of neurons responsible for the QEEG coherence and are strongly indicative of neuroquantological processes that allow an interface between extracerebral energies, neuronal membrane function, and his accurate experiences.

Key Words: out-of-body experiences, sensed presence, EEG, theta, gamma, geomagnetic variations, photon emission, neuroquantum effects

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Introduction

From the perspective of either materialism or idealism, the out-of-body-experience displays the face validity of a condition where "consciousness" appears to exist spatially separate from the locus (the brain) with which it is typically associated. The challenge is to discern the validity of the experience as an explanation for the information that is often acquired during these states. From a scientific perspective, this validity is strongly affected by the precision of the technology for measurement and its quantitative congruence with testable theories. This paper describes how the improvement of methods of measurement and the principles of modern neuroscience over the last 40 years, when applied to the capacities of Sean Harribance (SH), have progressively suggested a NeuroQuantology explanation for his OOBEs and the accuracy of the information he acquires during these states.

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That human thought and its manifestation within different states of consciousness would occur within the same domain as quantum mechanics was proposed by late 19th and early 20th century scientists such as Niels Bohr (1958) and Erwin Schrödinger (1944). In fact during this period many of the fundamental concepts implicating the role of the right cerebral hemisphere (Harrington, 1995) in altered states, including those associated with apparent access of information from distances not available through typical sensory processing (Gurney *et al..,* 1886), were developed. The requirement to accommodate space and time simultaneously, through variants of space-time manifolds, was also considered (Weyl, 1952).

The major impediment to the pursuit of these perspicacious ideas was the access to a person who could display these phenomena reliably under experimental conditions and the threshold of precision for measurements that would allow rational and quantitative testing to be pursued. During the latter part of the 20th century, Sean Harribance (1994) has shown a reliable ability to acquire information concerning the private memories and health of others, the occurrence of events or locations of people at great distances from his source of thinking, and to report very low probability events that have not yet occurred.

These capacities are more congruent with the assumption that consciousness and the associated experiences may be more optimally described as a field composed of quantized points distributed within four dimensions such as (Minkowski) space-time. These points would be functionally associated with all of the information contained within the space occupied by all human brains (Persinger, 2008). This approach would be divergent from the usual mechanisms by which information is acquired through narrow-band sensory modalities. From this perspective brain space and the structures that occupy it would be the frame of reference by which information is acquired or is manifested.

SH's accuracy has been sufficient to remain the primary source of his income, establish an institute to study his capacities, and encourage some government agencies that gather information about others to sequester his comments. The subjective experiences reported by SH during the acquisition of information involve OOBE-like conditions whereby he "projects" or "detaches" to be somewhere else. During this period he also reports perceiving entities or presences that facilitate the information upon which he is focused.

There is no immediate technology that would allow construct validation of his experiences. They may be considered equivalent to the explanation from the Ptolemaic perspective that the reason the sun rises in the east and sets in the west is because the sun rotates around the earth. Although we now appreciate that the earth rotates instead and the sun remains in its position, the experience and the information obtained from those experiences remain the same. In an analogous manner the accurate comments of hidden numbers by individuals who report the information was acquired during these OOBEs (Tart, 1967; 1969) do not validate their explanations or attributions for the accuracy. However the accuracy still remains.

An implicit assumption of neuroscience is that all behaviours are caused by the activity of neurons and coherent glial functions within the brain. A more accurate statement might be that both, behaviour and brain activity, are strongly correlated because they are caused by a more fundamental and shared substrate, such as *neuroquantal* effects. Any of these approaches would still predict that the accuracy of the SH phenomena should be correlated with measurable changes that infer brain structure and function.

There has been a long history of experimental demonstrations of exceptional access of information by Sean Harribance through mechanisms not known to date. In the early 1970s Morris *et al.,* (1972) reported SH's statistically significant ($p < 10^{-12}$) ability to discern if concealed photographs were those of men or women. Success rates were associated with increased proportion of alpha rhythms. During this period increased proportions of alpha rhythms were also associated with increased accuracy for reporting one of five different hidden symbols (Stanford and Lovin, 1970).

By the late 1980s as electroencephalographic technology

developed the most consistent pattern for individuals who displayed accuracy for hidden information involved the theta (4 Hz to 7 Hz) and 40 Hz bands over the right hemisphere (McDonough *et al.,* 1988). In a series of technically excellent measurements during 1997 with 19 electrodes and a data sampling rate of 128/s by a NeuroSearch-24 EEG System (Lexicor), Cheryl H. Alexander measured SH's profile and compared it to Lifespan Reference data base. Suboptimal neural function was indicated in the bilateral central, frontal and temporal regions of SH's brain.

When SH was projecting and accessing information there was a sudden peak in alpha power within P4, the right parietal region. During baseline, beta activity was dominant in the left occipital region while alpha activity was dominant within the right prefrontal region. When he was observing quasi-geometric forms, such as the Bender Visual-Motor Gestalt Test, anomalous beta activity occurred over his right temporal lobe. During this testing conspicuous diminished activity was observed over the left temporal region. Observing altered EEG patterns during different visual tasks was considered important because this is the primary sensory mode by which the human primate discerns its spatial environment.

The measurement of shifts in electroencephalographic activity with OOBE-related experiences is consistent with the relationship between normal psychological phenomena and both theta and alpha rhythms. The most common EEG correlate of the hypnagogic state is low voltage, irregular theta waves carrying superimposed fast beta activity (Schacter, 1977). Dream states contain a rich mixture of low voltage theta (variable) frequency patterns within which 2 Hz to 3 Hz "sawtooth waves", bursts of alpha activity, periorbital phasic integrated potentials, and sleep spindles are mixed. In contrast to classical blocking of alpha rhythms in response to sensory stimulation, the latter induces alpha activity if theta activity is present at the time of stimulation. Such functional connections suggest a natural process involved with the frequent observations of theta-to-alpha transitions during OOBEs.

The 1996 and 1997 Visits

During 1996 a complete neuropsychological, intellectual, and personality assessment was completed for SH when he first visited our laboratory (Roll *et al.,* 2002). Clinical interpretation of the approximately 100, norm-referenced, performance based standardized scores suggested mild hypofunction within the left prefrontal region and the left superior temporal gyrus as well as a gross structural anomaly within the right parietooccipital region. The dorsal parietal region was particularly implicated.

The latter anomaly was considered consistent with SH's life-long difficulties with spatial relationships. If he is taken to a place beyond the visual detection of his home where he has lived for years (even though he is familiar with the place) returning to his home is very difficult. Although traditional interpretation of the results of these neuropsychological tests has involved attributions to damage or injury, an equally valid interpretation would involve the presence of altered structures from genetic, congenital or ontogenetic influences. Sometimes altered structures imply very novel functions.

Scores for selected tests that primarily demonstrated this effect as well as randomly selected reference tests were correlated 0.89 with the scores for the same neuropsychological tests given one year later during his 1997 visit. There was no evidence of complex partial epileptic-like signs. Standardized personality inventories indicated elevated scores for factors from which psychologists infer humility, shyness and tender-mindedness. These scores were congruent with his social and clinical presentations. His scores for scales by which psychiatric concepts are assessed were all within the normal range.

At that time we used only three-channel (Grass Instruments P79) montages involving the frontal (F7, F8), temporal (T3, T4) and occipital (O1, O2) regions for interhemispheric and intrahemispheric measures. The filter was set at 10 Hz with a complete attenuation of any low frequency of "steady potential" shifts. SH's bipolar activity was dominated by beta frequencies rostrally and near-continuous trains of alpha rhythms over the posterior regions. This profile was

typical of the approximately 500 patients and subjects we had measured previously when they were sitting in the quiet (acoustic) chamber with their eyes closed. However this activity occurred when SH's eyes were opened. His heart rate ranged between 78 and 81 bpm with no evident aperiodicity.

Interhemispheric comparisons between the occipitotemporal areas showed more episodes of slow (7 to 8 Hz) alpha rhythms over the left hemisphere compared to the right. Over the right hemisphere higher frequency (>30 Hz) bursts with durations of between 100 and 400 ms were superimposed upon these slow alpha rhythms. The discrepancy was conspicuous qualitatively and suggested a marked elevation of activity over the right caudal hemisphere. The right hemispheric fast frequency superimposed upon lower frequency alpha rhythms was enhanced in intensity and duration when he was projecting to access information about others.

Harribance Accuracy

People who interact with SH are impressed by the accuracy of the information he relates concerning themselves and others, particularly if he views a photograph of a person known to the participant. The emotional impact is sufficient for many people to alter their beliefs concerning the validity of these phenomena. Whether or not these changes in opinions are related to the personal salience of the comments or the presence of SH had not been measured directly.

To assess the strength of this effect under controlled conditions, several experiments were designed. While sitting in an acoustic chamber that was also a Faraday cage, SH was asked to keep his eyes closed and to touch a series of envelopes, one at a time, that contained photographs of single persons. The 10 photographs were members of the near and extended family of a professor in another department who was not involved with the experiments. Each member had displayed at least one distinct medical diagnosis such as diabetes. The envelopes were presented with the photographs face down. SH's key words and phrases were written directly on the strip chart EEG recorded during the descriptions for each of 10 envelopes (and photographs) and verified with the typed, transcribed narratives.

The professor accurately paired 8 out the 10 photographs with the unidentified comments made by SH when he felt the envelopes containing the pictures. The professor was then given the typed transcript for each person and asked to rank the accuracy of SH's comments for that person: -1=not scorable, 0=not correct, 1=mildly specific, 2=moderately specific, and 3=very specific. A second rater (who had not seen the rankings) hand-scored the EEG record for the proportion of alpha rhythms per second (0, 1, 2, 3, 4, for 0, 1/4, 1/2, 3/4, 1) during the approximately 40 min period. Because only the occipital region showed the easily distinguishable symmetrical morphology of alpha rhythms (8-13 Hz) only this component was measured.

When the proportions (median=20%, range 0 to 90%) of alpha rhythms per successive (1,169) 2-s intervals were compared to the accuracy of the comments made by SH at the same time, there had been a conspicuous decrease (from 14% to 6%) in alpha proportions for the approximately 6 sec before and 4 sec after his comments that were ranked as not correct. For all three rankings of statements that were judged to be mild, moderate or very specifically correct the proportions of alpha rhythms remained constant. There was greater proportion of alpha rhythms for the moderate and specific statements compared to the mildly specific comments.

Single Photon Emission Tomography (SPECT)

To discern direct metabolic activity two Tc-99m SPECT ECD brain scans were completed on two separate days at a local hospital. SH was injected with a tracer prior to SPECT examination and then asked to either meditate or relax (one day) or to project into the photographs of a young girl who had been murdered (and about whom SH did not know). The period of relaxation and interpretation of the photographs occurred in the chamber. Each scan, which required 45 min, was completed at the local hospital and interpreted by an expert in the area of nuclear medicine (Roll *et al.,* 2002).

There was a striking relative hyperperfusion of tracer within the region of the paracentral lobule of the right parietal lobe when he was projecting into the pictures compared to the meditation period. The hyperperfusion extended dorsally and laterally into the superior parietal lobe. A second, very focal anomaly occurred within Brodmann area 44 adjacent to the Sylvian fissure in the right hemisphere. The areas involved with the right hemispheric pattern were similar but not identical to that reported by Newberg *et al.,* (2003) for Franciscan nuns who focused to "open themselves in the presence of God" during which time they reported a loss of the usual sense of space.

When referenced to uptake in the cerebellum SH's cerebrum showed hypoperfusion of tracer within both anterior temporal lobes during both days. The decrease was greater in the left hemisphere than in the right. Mild attenuation of uptake of tracers was also discriminable within the left thalamus and basal ganglia with a prominently reduced perfusion in the thalamic midline. Some focal decreased uptake within the left compared to the right inferior-orbital frontal poles was observed.

In many respects SH's cerebrum was similar to a person who experiences a REM (dream) like state that is voluntarily accessible or controllable during the waking condition. During normal episodes of dreaming there is increased glucose and oxygen utilization and concomitant minute but significant increases in brain temperature, blood flow, and neuronal activity with a slight enhancement within the right hemisphere. Protein synthesis and memory consolidation are markedly increased. During this period Bokkon (2005; 2009) hypothesized that visual experiences are the responses to actual fields of photons released from neuronal activity rather than a neurocognitive representation of patterns of action potentials.

Sensitivity to Physiologically-Patterned Magnetic Fields

SH's projections were frequently associated with experiences of also perceiving "others" which he attributed to either Jesus Christ or Mary. Their descriptions contained a quality typical of individuals who display electrical lability within the right temporal lobe. Behaviors (including consciousness) could be considered the manifestations of cerebral electromagnetic fields (McFadden, 2007) which display holistic properties. Considering the extraordinary microspatial complexity of the brain, different matrices within that volume could support or be resonant with the same electromagnetic field such that "the same behaviour" would be displayed. However each of these intracerebral synaptic configurations would have different sensitivities to stimuli to which the others would not respond.

We had suspected that rats with histories of "restructured" brain functions from dendritic reorganization subsequent to chemically-induced seizures and specific post-seizure medication would display normal behavior. However they would be particularly sensitive to weak intensity applied magnetic fields whose temporal patterns overlapped with intrinsic brain activity. Later experiments by McKay and Persinger (2006) demonstrated the validity of that assumption.

To discern the sensitivity of his experiences to weak (1 μT) physiologically-patterned magnetic fields, SH wore the Koren Helmet while he sat within a comfortable chair within the acoustic chamber. This helmet was constructed by Stanley A. Koren and me to generate spatially rotating, time-varying magnetic fields within the cerebral volume. We had reasoned that applied magnetic fields whose temporal structure and intensities most approximated that produced within the cerebrum would be those that had the greatest and most complex effect upon consciousness. Symmetrical, sine wave-like fields compared to the complex patterned fields would be analogous to the differences, within the neurochemical domain, of adding water vs an intricate molecular structure that can be specifically sequestered by a receptor.

The patterns of the field are generated by converting a series of numbers between 0 and 255 to equivalent voltages between -5 and +5 V. The specific voltages were sent, after conversion by a custom-constructed digital-to-analogue converter, to pairs of solenoids embedded within the helmet. There are four of these pairs arranged in an elliptical pattern at the level of temporoparietal region (for most people) when the helmet is placed over the head. An external commutator delivers the

pattern generated by the computer and DAC to each of the four pairs of solenoids in sequential order for 0.5 sec (total rotation time 2 sec).

In a single setting with a duration of 45 min SH was exposed in a counterbalanced order to either no field or to patterns that were either 3.3 Hz, 1.6 Hz, burst-firing, or LTP-generating for 2 to 3 min each. The helmet's switches were activated so that the right hemisphere produced approximately 10% greater field strength than the left when the fields were activated. This would be equivalent to a gradient of about 100 nT/10 cm (cerebral width) or about 10^{-12} T across the width of a neuronal soma. This order of intensity is considered the operating range for critical cerebral functions.

The 3.3 Hz and 1.6 Hz sinusoidal patterns were selected based upon a hypothesis involving delta rhythms and meditational mechanisms (Cook and Persinger, 1997). The burst-firing field is a frequency-modulated pattern associated with amygdaloidal activity and analgesia (Martin *et al.,* 2004). The LTP-pulse was a pattern that generates long-term potentiation (LTP) in neuronal ensembles when presented as electrical current to hippocampal slices (Mach and Persinger, 2009; McKay *et al.,* 2000). The most optimal temporal patterns to induce this effect is a single pulse followed about 170 msec later by 4 pulses in rapid succession with a functional frequency of between 100 and 200 Hz. The functional time was within theta range.

LTP is considered the major process by which the labile and transient electromagnetic equivalents of experiences are chemically and microstructurally (as dendritic spine growths) represented within the cerebrum. The functional manifestation of LTP is a permanent change in an ensemble of neurons such that the presentation of the same or similar stimulus configuration after the initial consolidation requires less energy to evoke activity in that ensemble. There is a direct neurochemical connection between the occurrence of LTP and the formation of dendritic spines (synapses) for which there about 10^{13} in the human cerebral cortices; they are assumed to be the primary physical correlate of a person's memories.

We (Mach and Persinger, 2009) later found that whole body exposure of rats to this pattern produced a very similar effect upon spatial memory as does direct interference (saturation) with electrodes of LTP within the hippocampus. Post-acquisition exposure to this LTP magnetic field pattern strongly interfered with the consolidation of conditioned fear while the burst-firing pattern was less effective (McKay *et al.,* 2000). Rats exposed to matched-frequency sine-waves did not differ from sham-field controls.

SH was instructed to press buttons that he held in each of his hands when he felt or saw a presence on the same side (left or right) as the button. If it occurred in front or behind him, he was instructed to press both buttons. The point of the experiment was to discern if his right hemisphere, being structurally and functionally different, might also be sensitive to weak, physiologically-patterned magnetic fields.

Whereas the number of button presses ranged between 5 and 12 during the no field, 1.6 Hz, 3.3 Hz or burst-firing presentations, button presses during the presentations of the LTP-pattern was 22. The ratio of button presses indicating experiences of presences or visions along his left compared to the right side ranged from 1.5:1 to 2.1:1 for all of the patterns except the LTP pattern. This ratio was 6:1. This clear left-side asymmetry confirmed the sensitivity of SH's right hemisphere to weak externally applied magnetic fields whose gradients were within the operational intensities of neuronal function (in the order of 10^{-12} T) and whose patterns are known to affect the hippocampus and the physiological patterns associated with memory consolidation and the active reconstruction of experience when the right prefrontal region is actively involved (Buckner and Petersen, 1996). The results also showed that the experiences could be evoked and modified experimentally.

The 2002 Visit.

By 2002 we were also employing 8 channel (the addition of the parietal region P3, P4) quantitative EEG (QEEG) measurements from 20 channel systems that involved monopolar (referenced to ear) activity over the left and right frontal, temporal, parietal, and occipital regions. The correlations between various

power measures within the 8 to 13 Hz range from related software and the typical visually-measured proportions of alpha rhythms during the same intervals for normal subjects had been verified to be >0.90. At this time SH had received international attention because of the information he reported regarding the hidden location of an individual held responsible by a dominant government for an international conflict.

Confirming Visual Field Measurements

Previous EEG patterns and neuropsychological results had indicated anomalous function in the left temporal lobe and right parietal region. To systematically confirm this inference, SH was exposed to the Kimura figures. Each figure, which was either a geometric or irregular shape, was presented by tachistoscope to either the upper left, upper right, lower left or lower right visual field.

The test (Persinger and Lalonde, 2000) involved presenting (for 2 sec each) 4 geometric and 4 irregular figures (n=8) in each of the four visual quadrants (learning or priming). For the test phase 64 shapes (half of them geometric), within which the original 8 figures were randomly distributed, were presented in a balanced sequence (5 sec each) to each of the four visual fields. SH was requested to press one button if he recognized the shape and another button if he did not. The total numbers of errors were recorded. To verify consistency he was exposed to three trials of the 64 shapes.

Of the 192 presentations SH committed a total of 50 errors, which was quite abnormal compared to normative data. The specific numbers (in parentheses) were upper left field (12), upper right field (20), lower left field (17), and, lower right field (1). Compared to the normative data this suggested dysfunctions within the right temporooccipital, left temporooccipital and right parietooccipital regions with above normal functioning within the left parietooccipital region.

Specific analysis indicated an inability to recognize irregular (non-geometric) familiar or unfamiliar shapes presented to the upper right visual field (processed by the left temporal lobe) and lower left visual field (processed by the right parietal region). The deficit was less evident with geometric shapes. These patterns were congruent with previous electroencephalographic patterns including the observation by Alexander of diminished activity in general within the left temporal region.

Replicated Harribance Accuracy

SH usually reports that he experiences brief images of information regarding the person upon whom he is focused. In some instances he reported that "*he leaves this space and checks in the book*". The descriptions are similar to other traditions such as accessing the *Akashic record* or St-Peter's cumulative compendium. In order to discern the accuracy of the comments he states, each of three volunteers were asked to bring 10 photographs of members of their families (total=30 paragraphs). Each photograph was placed in a separate opaque envelope.

While SH was sitting in a dimly lit room with his eyes closed, each envelope containing a picture (face down in the envelope) was placed in his hand. He was monitored by one experimenter to insure that his eyes were closed. In another series of experiments, involving 30 photographs (from 3 different subjects), he opened the envelopes and viewed the photographs while making comments. His comments about each envelope (or photograph) were tape-recorded (and later transcribed) while his electroencephalographic activity was recorded over the occipital (O1, O2), temporal (T3, T4) parietal (P3, P4) and frontal (F7, F8) regions.

When SH was experiencing information he was less accurate for tactile and visual information presented along the right side of his body. The effect was most evident within the lower right peripheral visual quadrant. When he was experiencing perceptions outside of his body, especially if he experienced a "guide" or presence during his experiences, he was more likely to look up and to the left. There was also more frequent use (by about 20%) of his left hand for both holding the envelopes and gesturing.

About one to two weeks later, in a different setting, the individuals who brought the photographs were asked to read each of the 10 unidentified transcripts (presented in random order and designated by letters) containing the descriptions generated by SH. The subjects were instructed to place each of

the 10 pictures they had supplied beside the transcript that best described the individual in the picture. The subjects were instructed to ignore statements regarding gender and to focus upon the unique characteristics that defined each person. After the pairings had been made, the actual picture associated with each narrative was identified for the subject. Each subject was asked to rank each comment (about 10 to 30 comments per photograph) on a 1 to 3 scale where 1 was minimal relation to the person in the photograph and 3 was "a definite" characteristic of the person in the picture; 0 was reserved for "don't know". The procedure was similar to that employed in his previous visit.

For the narratives that were completed when the photograph was in the envelopes two of the subjects accurately selected the person in 8 of the 10 photographs and one subject accurately selected 6 of the 10 photographs based exclusively upon the narratives given by SH without knowing which narrative was associated with which photograph. These narratives were based upon SH's experiences when he touched the envelopes containing the photographs that he did not see. The subjects who paired the photographs with SH's narratives when he held and visually inspected the photograph accurately paired the narrative and photograph between 4 and 6 of the 10 cases. In other words his accuracy was greater when his eyes were closed and he subjectively "entered into the picture" while he felt the envelope containing the picture.

Pixel Density of Photographs

The significance of the information within the photograph was discerned by selecting 5 photographs of individuals known very well by a volunteer and then digitally copying the photographs with progressively diminishing pixels to 1200, 600, and 300. SH projected into and read the 20 photographs; the narratives for each were transcribed. There was no significant difference between the numbers of statements (range 10 to 20) made for each of the four types of photographs or the duration of description (about 1 min) required to respond to the stimulus.

About six months later (the time required to transcribe the tapes) the volunteer was given the original pictures and the four unmarked transcripts for each of the pictures (from SH responding to the original and the three pixel densities) and asked to rank the congruence of each comment on the 0 to 3 scale used previously. Spearman rho analysis indicated a correlation of $r=0.40$ ($p<.05$) between the ranking and the pixel density. Stated alternatively as the pixel density decreased for the photograph given to SH, the ratings of the magnitude of the salience of his statements decreased.

EEG Measurements and Accuracy

Over the four days of the 2002 visit qualitative EEG strip chart measures revealed a persistent and maintained enhancement of alpha rhythms over his right parietal region, although the amplitude varied. We would not have observed this activity during his first visit because we did not measure this area. In the three experiments where SH showed the greatest accuracy (when he did not see the pictures but felt the envelope), the rated accuracy of each narrative and both the duration of alpha rhythms and the relative power in $\mu V/Hz^2$ were correlated by rank (Spearman) correlations (10 scores per experiment) for activity over the occipital region in order to be consistent with previous studies.

The correlation coefficients between the proportion of alpha rhythms during the statements or the power measures and the rate accuracy ranged between 0.71 and 0.85 for all three experiments. For two of the three experiments there were also strong correlations between the numbers of maximally accurate ratings and the proportion of alpha activity and power over the right parietal region. Partial correlation analyses indicated that the alpha activity over the right parietal and both the left and right occipital regions were related to the same source of variance.

Brain Response to Standardized Faces with Emotional Expressions

SH prefers to look at the faces of people in photographs and to project into them to discern information. However photographs randomly selected by people have personal significance and are not standardized. To discern if SH was responding to fundamental facial patterns he was asked to view the

Ekman faces. They represent the basic emotions expressed by people trained to simulate these conditions.

In a single setting, SH viewed all of the Ekman pictures (Morris *et al.,* 1998) presented as 35 mm slides (15 sec each) while his EEG (F7, F8, T3, T4, P3, P4, O1, O2) was measured. The most conspicuous and consistent effect was an inordinate increase in the gamma (40 Hz) range over the right temporal lobe only when the pictures were presented, regardless of the emotional expression shown in the photograph. After the experiment SH stated he was trying to "inhibit reading" the pictures because they were "empty".

This pattern of activity was consistent with Alexander's observation when SH attempted visuospatial organization of Bender Gestalt figures. Muller *et al.* (1999) found that processing of affective pictures modulated gamma band EEG activity in the right hemisphere as well. However, as we had found with normal subjects, the change in power was much less than that displayed by SH.

If the processes by which SH was acquiring information (although his experience was that of projecting into the scene or listening to an entity) involved an intercalation between the two hemispheres, then during his experiences there should be a greater similarity of the potentials between the two hemispheres. Quantitative EEG analyses were completed for the traditional range in frequency bands while he was simply resting with his eyes closed or accessing information.

The most significant change occurred within the 38 to 42 Hz range. When resting with the eyes closed the mean and standard deviations for voltage over the left parietal lobe were 2.5 and 1.1 μV, respectively. Over the right parietal region, these values were 4.5 and 1.9 μV. However when he was acquiring information the values over both hemispheres converged to about 4.6 μV (SD=3.8 μV).

The same effect occurred in a psychologist's office offsite from the university while activity over SH's left and right parietal (P3, P4) region was measured by a biofeedback unit. During his reading of the psychologist and the "projection to read the cosmic book about the psychologist's past, present, and future", the asymmetrically increased power within the "beta" (which was actually fast beta within the 35 to 40 Hz increment) range over the right parietal region observed during baseline attenuated and the two hemispheres equalized.

Magnetometer Readings

The role of subtle variations in the earth's magnetic field in OOBE and access of information through mechanisms not known to date has been shown by correlational analyses (Persinger, 1995a). The right hemisphere of the human brain has been more related than the left to experiences traditionally allocated to the spiritual domain (Kurup and Kurup, 2003; Urgesi *et al.,* 2010) as well as belief in phenomena that appear to deviate from normal operations of space and time (Brugger *et al.,* 1993). The right hemisphere is particularly sensitive to changes in low intensities of geomagnetic activity (Mulligan *et al.,* 2010).

We placed the sensor from a MEDA FVM-400 magnetometer beside the left and right parietal regions of SH's head while he sat within the acoustic chamber when he was projecting and acquiring information from photographs and when he was not. A clear attenuation within the 1000 nT range was noted within the plane parallel to the surface of the head (as seen from the top) on the right side but not on the left when was projecting. This attenuation was not noted in the other two planes and did not occur when he was simply relaxing.

At the time we hypothesized that anomalous attenuation of the earth's magnetic field immediately adjacent to his right parietal region could be associated with the increased metabolic activity recorded by SPECT as well as the EEG activities (He was reluctant to complete either a MRI or CT, so we had no estimation of possible differential thickness of the skull). We considered the possibility that information contained within the earth's magnetic field (or the space it occupies) might affect his brain, be accessed under certain conditions because of the structure of his brain, or, be responsible for his acquisition of information as perceptions of projection.

The possibility of directly accessing every human brain by electromagnetic induction of algorithms had been considered (Persinger, 1995b). It was derived from

concepts such as the geopsyche (Persinger and Lafreniere, 1977) and the ecological unity of the geomagnetic field with the life systems that evolved within it. Every human being can be considered a complex semiconductor immersed within and connected to the earth's magnetic field (Persinger, 1983). If we assume the 6 billion human brains are equivalent to wires connected topologically and are adjacent because of their immersion in the geomagnetic field, then a quantitative estimate of the shared "induced magnetic field" can be estimated.

The induced magnetic field B would be equal to 1/2 * (* indicates "multiplied by") u, the permeability constant (1.26×10^{-6} N/A^2), *i*, the cross-sectional current 10^{-13} A/m^2 for the brain's dimensions and d is the linear distance of 6×10^9 (6 billion) brains. The value for the magnetic field strength would be in the order of 10s of picoTesla which is within the operational range of the single brain. Such similar quantitative ranges set the potential for interactions between intracerebrally generated magnetic fields and those induced by an exogenous field within which all the brain are immersed. It also might explain the repeated observations that remote information about the state of emotionally significant others to the *experient* is more accurate and more likely to occur during dreams on nights when the geomagnetic activity or "noise" is less than the days before or afterwards (Krippner and Persinger, 1996; Persinger and Schaut, 1988).

With such functional connectivity the concept of magnetic diffusivity becomes applicable. If one assumes each brain exhibits the bulk conductance of physiological saline (2.1 S/m) then the diffusion rate for magnetically-mediated information can be solved by the reciprocal of the product of u and this conductance; it is $.378 \times 10^6$ m^2/s. With a cross-sectional area for all human brains approaching 9×10^7 m^2 the division by the diffusion rate estimates a time of about 4 min for a change in one brain to be affected (or to be discerned) potentially by all brains that contributed to the formation of the field. Of course such calculations do not prove that such a connection exits but simply suggest that a physical approach (even as a metaphor) to phenomena such as the Harribance effect could lead to some testable hypotheses that can be supported or rejected experimentally.

Experimental Attenuation of Harribance Accuracy

SH was again exposed to the burst-firing and frequency-modulated fields that we have employed to induce a sensed presence in hundreds of volunteers (Persinger and Healey, 2002) with or without a history of OOBEs. The sensed presences are not correlated with the person's suggestibility as defined by direct measurement before and after the 30 minute exposures (St-Pierre and Persinger, 2006). However slightly higher (by 10%) stimulation over the right hemisphere compared to the left hemisphere enhanced suggestibility scores in normal volunteers with minimal contribution from *a priori* elevated temporal lobe sensitivity as inferred by psychometric testing. This effect was very important for therapeutic interventions and required care in the phrasing of post-exposure casual conversation with the patient.

For SH, 30 min of exposure to these complex fields with slightly greater intensity over his right hemisphere was associated with a four to six fold increase in reporting sensed presences, particularly along his left side. Although his experience was to project himself into the space of the person upon whom he was focusing there were frequent concurrent experiences of sensed presences that he labelled as spirit guides whose names changed over the years without any apparent systematic pattern.

His experiences of these presences at the time he was focusing upon a photograph were associated with a significant increase in the averaged rated accuracy of his comments by at least a factor of 2. The concept that the sensed presence or the "visitation by others" may be a perceptual motif for the acquisition of information in space-time has been considered by many authors (Evans, 1984) and may have experimental support (Booth *et al.,* 2005; 2009). From the perspective of the vectorial hemisphericity hypothesis (Persinger, 1993), the sensed presence or the perception of "another" is the cognitive experience of intrusion from right hemispheric processes and the information associated with them while the OOBE is the reversed pattern (Saroka *et al.,* 2010).

During several trials we found that an equalized bilateral application over his parietotemporal regions with the same long-term potentiation (LTP) pattern employed previously decreased the proportion of alpha rhythms to about 25% to 30% of baseline (no field) conditions. The rotation time for one complete cycle for the stimulating pairs of solenoids of the helmet in this series of experiments was 20 sec as compared to 2 sec. There was also a concomitant decrease in his accuracy by about 20% of his information during the field presentations as defined by other people's ratings of his comments for the various photographs. Although the experimental application of these fields did not eliminate the accuracy of his experiences, their magnitudes were reduced.

Similar to the results from previous visits, the data clearly indicated that his experiences were coupled to brain functions strongly correlated with hippocampal activity and were potentially influenced by appropriately and physiologically-patterned weak magnetic fields. The intensities of these fields, in the order of 1 μT, would be associated with energies in the order of a nanoJoule (10^{-9} J) as calculated by $J=[B^2/(2*4pi*u)] * m^3$ where u is the (magnetic) permeability for space and m is the volume of the brain. Given that a single action potential with a value of 1.2×10^{-1} V (120 mV) exerts an energy of about 2×10^{-20} J (Persinger, 2010) on a unit charge of 1.6×10^{-19} As and there are in the order of 10^{10} neurons throughout the cerebrum with an average frequency of 10^1 Hz, this means the total energy (10^{-9} J) from the applied fields could directly interact with the sum of the membrane electromagnetic phenomena associated with thought and consciousness.

Since that time we found that the issue of "focusing" particular patterns from a diffusely applied weak magnetic field is less technically challenging than anticipated. Other researchers have found that different structures of the limbic system such as the entorhinal cortices and hippocampal formation respond to different complex temporal shapes of electric currents that produce LTP. Whole body application of these same different shapes as magnetic fields during periods of extreme electrical lability permanently changed these specific regions even though the pattern penetrated the entire brain (Lagace *et al.,* 2009). These results also indicted that those cerebral regions with enhanced metabolic activity (intrinsic or experimentally-induced) may display qualitatively different properties which allow the brain's interaction with the applied, appropriately-patterned, very weak magnetic fields.

The phenomenon would be similar to the effects of hypophyseal hormones which are released into the blood and travel throughout the body but only affect those organs for which there are specific receptors to which to be sequestered. SH's response to a simple LTP field suggests that a component of neural pathways or fields that contribute to his access of information could involve the hippocampal formation and the electromagnetic patterns associated with it.

The 2009 Visit

By 2009 (Hunter *et al.,* 2010) the technology available was sufficient to test the quantum bases to SH's OOBEs and related phenomena. We had two Model 8-16C EEG units interfaced to a National Instruments PCI-607IE Multi I/O Board computer interface card. The data could be extracted at 1000 Hz by a DELL Dimension 8100 Personal computer on a Windows 2000 Professional Platform. Multichannel sampling was manually recorded to fixed disks. We also had a QEEG Mitsar 201 system amplifier which sampled at 500 Hz and 16 bit analogue to digital conversion. WINEEG v2.82 was utilized for data collection, artefact removal, and spectral analysis. The electrode cap (Electro-Cap International) utilized 19 AgCl electrodes and was capable of both monopolar and bipolar recording. We had experience with both interhemispheric coherence analyses and microstate profiles (Koenig *et al.,* 2001).

Source localization was completed by using sLORETA (standardized low resolution electromagnetic tomography). Coherence of frequency and power between hemispheres was calculated by web-available software. We also had two MEDA magnetometers and photomultiplier tubes to discern potential photon emission. For one experiment SH read 40 photographs supplied by 4 volunteers, similar to previous periods. However this time the volunteers were given the photographs

that were read and the associated comments together and then asked to rank each comment for accuracy. The composite scores correlated significantly with the various power measures from the quantitative EEG data of SH at the time of his "reading" at which the volunteers were no present.

The most obvious profile of SH's quantitative EEG (QEEG) was maintained bursts of gamma (30 to 40 Hz, especially 33 to 35 Hz) over his right rostral parietal-temporal (C4, T4) and right central and orbital frontal region when he was "calling an angel", one of his variants of projecting into a photograph. During this period the power peaked around 20 Hz for sensors F8 and T4 (right frontotemporal area). sLORETA showed the enhanced activity extended into the insula and temporal cortices of the right hemisphere.

The involvement of the insula was considered important in light of the history of SH's health issues, his feeling of another "consciousness" associated with his visceral region, and recent reports of correlations between right anterior insular activation and the experience of "an inner voice" (Craig, 2009). The correlation between the numbers (total durations) of the specific EEG configuration, that was so consistent we labelled it the Harribance Configuration (HC), and the average ratings of accuracy by the volunteers of SH comments about the photographs was 0.46.

Microstates are the more or less consistent electrical potentials that exist over most of the entire cerebrum for durations of between 80 and 120 msec before a reconfiguration occurs. From early childhood to old age most of the global activity of the cerebrum can be accommodated by four microstates that are remarkably similar for normal people (Koenig *et al.,* 2001). Even classic pathologies, such as the schizophrenias, are associated with changes in the durations or temporal mixtures of these microstates rather than qualitatively different microstates.

The configurations are dominated by isopotentials of opposite polarities. The duration is similar to the experience of a percept and the average duration (100 msec) is equivalent to 10 Hz, one of the major power peaks in human brain function. We agree with other researchers (Lehmann *et al.* 1998) that these microstates are optimal candidates for the "atoms" of thought. In fact the temporal combinations of these states, if depicted as 4^{10} (100 msec per state and 10 per second) would allow serial combinations of digital combinations to accommodate the estimated information content of "experience".

SH showed these normal states when he was resting. When he was accessing information, the durations of the states decreased to about half the time. Stated alternatively the changes were equivalent to 7 Hz rather than 3 to 4 Hz which is typical of the normal person. During his projections a previously unmeasured microstate emerged over SH's brain that showed the same polarity over the left and right parietotemporal hemisphere as if the two were "doubles". It met the general criteria for a macromanifestation of a Zeeman-like phenomenon (Persinger *et al.,* 2008a). This occurs when the emission spectral lines "split" as the electron shells of a Bohr atom are exposed to a static magnetic field. The Zeeman measurement was one of the first experimental effects to support quantum theory.

The particular "double single polarity" pattern over SH's cerebrum was correlated with comments referring to events that had not occurred, at least from the rater's perspective. We later verified some of the events reported by SH occurred later or were correct but not known or at least reported by the raters. On the other hand the anomalous microstate that was most significantly correlated with the rated accuracy of his statements for the 40 different photographs involved opposite polarities over the right prefrontal region and the right temporoparietal lobes. This was the same region shown in the SPECT analysis to be simultaneously activated and suggested a functional association during his experiences that were associated with independent accuracy.

We also found that SH's perception of "now" was different than the average person. This is discerned by a temporal discrimination task where a person must indicate which of two symbols (on the left and right of the screen) occurred first. The latency between the randomly presented onset of the left or right symbol in our procedure ranged between 5

msec and 40 msec. Normal individuals require a temporal discrepancy of at least 28 msec to perceive temporal order (one symbol appearing before the other). For SH, the optimal timing was between 10 and 20 msec. For durations longer than these values he was actually less accurate.

Photon Emission

Considering the persistent electroencephalographic patterns, the SPECT data, and his neuropsychological profile, we tested the possibility that SH emitted photons from the active region of his brain. A model 15 Photometer from SRI Instruments with a PMT housing (BCA IP21) for a RCA tube (no filters) was calibrated such that a change in one unit was equivalent to 1.5 x 10^{-11} W/m^2 or a total energy of about 1.5 x 10^{-11} J/s at the distance measured within a dark room (not the traditional chamber).

While sitting in this dark room SH was requested to project himself (or his angel) into the photomultiplier tube (about 0.5 m away) in a manner that was similar to reading of photographs. He showed a reliable increase in photon emission by at least 1 unit of average transmittance, compared to the relaxing or meditating baseline, when he engaged in this process. The latency between the instruction to concentrate or project himself and the increase in photon emission from the right side of his head was between 10 and 20 s. Spectral analyses indicated that the intrinsic variations of photon emissions during the periods of elevation were between 0.2 Hz and 0.4 Hz.

Geomagnetic Field Changes Around SH's Head

We found, similar to our previous measurements, that the horizontal (parallel to the top of the head) static magnetic field of the earth was about 2,000 nT less over SH's right temporo-parietal region compared to his left. When he projected or "accessed his angel" there was a decrease in the earth's magnetic field along the right side but not the left side of his head. The changes, which began about 10 to 20 sec after he began projecting, were about 150 nT, 15 nT, and 5 nT at distances of 1 cm, 25 cm and 100 cm, respectively, from the right side of his head. Fourier analyses of the variations were in the 0.2 Hz to 0.6 Hz range.

According to the classic equation J=(B^2/2*4pi*u) multiplied by the volume, the energy change within the volume of his cerebrum during the projection would have been about 10^{-11} J. Application of the decreases in geomagnetic intensity in the horizontal plane for the values at 25 and 100 cm remained equivalent to 10^{-11} J. Stated alternatively there was a conservation of energy associated with the decrease in geomagnetic intensity and increase in photon emission when he was projecting.

This increment of energy within the range of 10 pJ/s is well within the magnitude generated by the neuroelectromagnetic components of brain function. Given the quantum unit of an action potential (Persinger, 2010) is about 2 x 10^{-20} J, 10^{-11} J would reflect cerebral clusters of neuronal activity. This would be about 10^9 action potentials for a billion neurons displaying one action potential per second or 100 million neurons with an average frequency of 10 Hz.

These numbers are well within the range expected to be activated given the perfusion ratios from the SPECT, the power amplitudes from the quantitative EEG and even his personal experiences of "sensing heat" over his right parietal region. One would expect that measures by the SPECT and his propioceptive reports would also reflect the contribution from the concomitant metabolic sources associated with regional blood flow. The convergence of the order of magnitude for energy from neuronal activity, photon emission, and the changes in the proximal geomagnetic field intensity suggests that SH's brain would have access to information associated with or contained within the earth's magnetic field or the space it occupies.

The phrase “or the space it occupies” reflects the nature of the physical world. The smallest discernable unit of space, Planck's length, is in the order of 10^{-35} m while the largest length, the width of the universe, is in the order of 10^{26} m. This means there are more degrees of freedom within "inner space" and that below the spatial dimensions (about 10^{-15} m) within which matter is manifested there is the potential for multiple other organizations of that smallest unit. Each of these configurations, like the Klein-Kaluza domains, may display properties and principles of function that circumvent the

limitations of the systematic relationships ("laws") displayed at larger levels of discourse (Persinger and Koren, 2007).

The Effects of SH's Proximity to Subjects

People often report they feel different after close proximity to SH; this has been attributed to the accuracy of his information about the subject's memories. To discern if there was any quantifiable effect upon the subjects, who usually sit within 2 m of SH, a series of double EEG experiments were completed. The QEEG activity of both SH and the subject were completed simultaneously and subsequent coherence analyses were performed.

An effect was shown conspicuously in all four separate subjects. As the duration of the proximity increased over the approximately 15 to 30 min period there was increased similarity in the EEG patterns over the temporal lobes of SH and the subject. The increased similarity was most apparent within the 33 to 35 Hz range. More specifically, there was increased coherence within the 19 Hz to 20 Hz range and the 30 to 40 Hz band for SH's right temporal lobe and the subject's left temporal lobe.

Further detailed analyses of successive 1-Hz increments showed that the power within the right and left temporal and parietal lobes of the participants demonstrated a conspicuous decrease within the 1 Hz to 10 Hz band over the right parietotemporal regions compared to these regions in the left hemisphere. The only exception was the approximately 10 fold increase in power within the 6 Hz to 7 Hz band over these right hemispheric regions compared to all other 1-Hz increments.

From a parsimonious perspective, this pattern would be congruent with a process that allows SH's right temporoparietal region, the one that has shown the persistent anomaly, to become resonant with the left temporal region of the subject. This would be the same region associated with the representation and consolidation of experiences that become the individual's memory. The increased power within the participants' brains within the 6 Hz to 7 Hz range, the prominent fundamental frequency for the Schumann resonance between the earth's surface and the ionosphere, would be consistent with the hypothesis (although there are many others) that information could be accessed through the earth's magnetic field or the space it occupies.

In a singular experiment SH and a female subject faced each other while sitting; the distance between the two was 5 m. A magnetometer sensor was stabilized at a distance of about 2 cm along the right side of SH's and the subject's head. Two laptop computers recorded the variations at 3 samples per sec as SH "read" the subject over a 20 min period. Although there were multiple competitive stimuli from construction and environmental noises, subsequent analyses indicated that the "random" fluctuations (removing the extreme outliers from likely body movement artefacts) between the two, particularly the 1 nT (the threshold for the instrument) to 5 nT variations within the 0.4 to 0.6 Hz range, shifted from a congruence of about 0.2 (not statistically significant) during the first 5 min to about 0.7 during the last 5 min.

General Discussion

The consistency of the Harribance effects between and within experimenters suggests that stable structure does dictate stable function and small changes in structure change function. For a physical event to become a stimulus it must evoke a response. It has become clear within the last few years that the human cerebrum responds to changes in the environment without personal awareness (Berns *et al.,* 1997). There is also evidence that the events to which the brain responds is a function of its state at the time of stimulation.

Consistency with Contemporary Modern Neuroscience

The unity of the various states of consciousness requires coherence of neuronal functions over large cerebral areas for brief periods in order for conscious experiences to be both highly integrated and differentiated (Tononi and Edelman, 1998). These conditions involve re-entrant processes within pathways between the thalamus and cerebral cortices for the normal waking state. During dreams input from hippocampus-amygdaloidal structures contribute to the "circuitry". Under normal conditions the re-entrant processes are in the order of 10 to 20 msec (Llinas and Ribary, 1993) and constitute

the equivalent of a second or third derivative (Persinger *et al.,* 2008b).

From a neurocognitive perspective, SH's experiences of "projecting his consciousness" into photographs to extract information, observing entities (some of whom are iconic religious figures), "looking through 'the book' of a person's life" and the variants of these themes are well within the normal range of cognitions. They would be expected subjective perceptual representations of the information from transient intercalations between his left and right hemispheres. When one dreams of being somewhere else the experience does not necessarily indicate his consciousness is dislocated from the brain to this place. However even if the processes that generate the experiences are illusory, like concluding the sun rotates around the earth, the altered configurations of brain states could allow detection of stimuli and access to information below the threshold of other states.

More specifically, the EEG data suggest that during brief periods the functional connection between his right temporoparietal and prefrontal regions are accessed by his left temporal regions during which time he experiences the information. It is perceived as transient "pictures" or "flashes", often within the upper left visual field, that are compared to a kind of "moving picture" with "flickers". They were estimated by him to be approximately 5 to 10 times per sec, that is, within the range of theta to alpha activity. The frequency bands that were associated with his experiences were within the range well known to be associated with transient altered states and the cognition of clusters or fields of cerebral activity.

For example Lehmann *et al.,* (1995) compared 23 cognitive ratings and 124 EEG spectral values and found a dominance of four distinct pairs of canonical variables. Canonical correlations reflect quantitative associations between the optimal combination of variables that compose one "field" of an aggregate of variables with those of a another "field" of an aggregate of other variables. An underlying assumption is a linear relationship between the variables that compose each field.

The first pair involved 2 Hz to 6 Hz peaks that were symmetrical over both hemispheres and 13 to 15 Hz peaks over the left hemisphere; the concomitant cognition was similar to hypnagogic states. For the second root, power peaks in the 4 to 7 Hz band over the medial right hemisphere (the dorsal parietal region) were associated with sudden (particularly motive) ideas with a reduction in body perception and orientation.

The third pair of canonical variables showed a very step trough at 7 Hz with marked convergence between the left and right temporal regions within the 19 Hz to 30 Hz range. This condition was associated with predominantly acoustic experiences with themes referring to the present and not the past. The fourth canonical condition involved a distinctly narrow trough between 7 Hz and 9 Hz with concomitant reality, future-oriented thoughts. These patterns are similar to those measured during the Harribance effect.

The information content of any single momentary act of conscious perception by SH would be determined by his microstates. Huang *et al.,* (2007) found that normal awareness is involved with access to only one feature value at a time but to more than one location simultaneously. Multiple location values can be represented as a holistic pattern. If a percept's duration is about 100 msec and the integrative period of correlated activity over large areas of the cerebral cortices or manifold is between 10 and 20 msec, this would permit between 5 to 10 features per percept.

The experimental verification of near-zero correlations and perhaps active decorrelation (Ecker *et al.,* 2010) between evoked spikes from neurons with shared input, an observation that was superficially contradictory to the arrangement of cortical columns with strong intracolumnar functions, actually allows greater accuracy for detection of small changes in neuronal populations (Renart *et al.,* 2010). This condition also facilitates organization of large numbers of small functional aggregates of neurons over very large areas that would be sufficient to produce organized microstates.

Travelling waves would allow cortical areas to communicate over large distances compared to the width of soma. Burkitt *et al.,* (2000) estimated the velocities to be 7 to 11 m/s. Nunez (1995) estimated the values to be between 4 and 8 m/s. With a functional cerebral length of about 10 cm, the time

required for the completion of the travelling wave would be about 10 to 20 msec. These values have quantal significance.

The momentum (h/wavelength) for de Broglie's "matter waves", when solved for either a proton or an electron with a radius of 2.82×10^{-15} m is 2.35×10^{-19} kg m/s. If a packet of particles was moving at 4.5 m/s the coherent energy would be in the order of 10^{-20} J. This again is the quantal energy associated with an action potential. A state where the value for the representation of the whole is equal to the value for each unit that composes the whole sets the conditions for the emergence of a condensate.

The cohesion by temporal association in distributed space rather than gross concentrations of numbers of neurons would allow the emergence of the conditions of a complex field. One special type of field, the holonomic (holographic) form, requires the condition where each unit is distributed over the whole and therefore each unit or part contains the whole (Pribram and Meade, 1999). That the human cerebrum quantitatively displays this property (di Base, 2009) is suggested by the convergence of the energy value (10^{-20} J) for the single unit (the action potential) and for the property of the whole unit. According to the equation $J=B^2/(2*4pi*u)$ multiplied by the volume of the cerebrum, an operational cerebral magnetic field intensity of about 5 pT would also be associated with an energy of 10^{-20} J. One of the consequences of such “field-like” organization is that only *one* neuron is required to produce a change in the organization of the field (Li *et al.,* 2009).

The web of synaptic connections (dendritic fields) distributed in brain space within which variations of the cerebral electromagnetic field exist would support the hologram. Gabor initially employed Hilbert phase space (Van Quyen *et al.,* 2001), in which the frequencies of the wave forms from Fourier transformations composed one axis and space-time composed the other. There are more rigid spaces whose square is the Hilbert space (Dijkstra, 1985). Within brain space the fundamental frequency associated with the energy from the action potential is 3×10^{13} Hz (about 10 um, the average width of a soma) while the width of the synapse (0.5 to 2 um), where interference patterns would be created, displays an average of 3×10^{14} Hz. It is not coincidence that the difference between these two values is the multiplier 10 Hz (range 5 to 20 Hz).

A primary question then arises: why don't other people show SH's capacities with comparable proclivity? The evidence suggests that many people do but their capacities and accuracies are dependent upon a transient functional connection due to electrical lability rather than an initial structural organization. Individuals with histories of complex partial epileptic-like signs and experiences have been shown to report more of the types of experiences and accuracies as does SH (Booth and Persinger, 2009). However their phenomena are briefer and, as one might expect, contain higher error rates from the convergence and synthesis of normally acquired sensory information into these percepts. Because SH has displayed these experiences since childhood, he is more likely to have acquired linguistic labels and images that are more valid and consistent with the accuracy of the information.

The simplest interpretation of the strong coherence between the right temporal lobes of the subjects who volunteered to sit in front of SH and his left temporal lobe while he "read their past, present, and future" would be that his brain directly accessed the information within the subject's brain. Modern neuroscience in general and the theory of the mind (TOM) in particular have shown a person's ability to interpret or infer the mind of another is strongly correlated with activity within the temporoparietal junction of the right hemisphere (Sax and Wexler, 2005; Vogeley *et al.,* 2001). Such inferences can be remarkable accurate.

When this junction is stimulated electrically by surgical techniques, there is a sense of self-transcendence (Urgesi *et al.,* 2010) and the feeling that the "consciousness" is somewhere else (Saroka *et al.,* 2010). Olaf Blanke's excellent research (Arzy *et al.,* 2006; Blanke *et al.,* 2004) showed that stimulation of the right parietotemporal junction was associated with out of body experiences while stimulation of the left was associated with the sensed presence. Although this appears to be a reversal of the vectorial hemisphericity hypothesis (Persinger, 1993) any process producing the vectorial solution for a left/right

hemispheric discrepancy will elicit the effect. In the Blanke studies the stimulation of the right hemisphere was more likely to have inhibited this region and allowed the intrusion of the left hemispheric field while inhibition of the left hemisphere would have encouraged the sensed presence.

The Potential Geomagnetic-NeuroQuantum Possibilities for Sean Harribance's Access of Information

The consistency of neuromeasurements and the independent verification of the accuracy of the Harribance effect indicate a reliable physical process that should be accommodated by mechanisms at all levels of scientific discourse but most explained by neuroquantology. This statement is based upon the assumption that neuroquantological phenomena are the origin for the interactions between matter that compose the brain and the electromagnetic processes that both occupy and converge within this volume.

There is no *a priori* reason, except for parsimony, to assume that the mechanism or process by which SH acquires the information is singular. There are at least two operations that could accommodate his experiences. The first involves direct access of information from the other person's brain. The second involves resonance with information that would require a representation of all human experience within a space to which individuals with specific brain patterns gain intermittent interface and hence access.

The Harribance effect for proximal individuals indicate that there is more than just intuitive inference, although these "Newtonian" neurocognitions would be expected to contribute to the total experience and could explain the significant proportion of "common sense" statements he makes about the person that are comparable to what a seasoned interpersonal expert might also report. As the person listened to SH and engaged in the ecphoria (Wheeler *et al.,* 1997) of integrating what he was saying with what they remember about the events to which he is referring, the simultaneous activation of the right prefrontal region and hippocampus would have allowed SH's brain to be resonant with this information.

This could explain the subjective experiences by subjects that SH's accuracy increased as his duration of interaction with them increased as well as the enhanced coherence between the two brains over time that we measured. The reconstruction of episodic and autobiographical memories would involve the right prefrontal region (Fink *et al.,* 1996; Sturm *et al.,* 1999; Wheeler *et al.,* 1997) of the subject while the interpretational awareness of the experiences, a more left temporal lobe process, would have dominated SH's contribution. The integrity of the left hemisphere is also associated with person's ability to relate to the belief of others (Samson *et al.,* 2004).

That the hippocampal formations, which are prominent medial structures of the temporal lobes, contribute to SH's experiences and accuracy was suggested experimentally. His experiences and visions of presences were enhanced when a magnetic field known to affect hippocampal function was applied with a slight enhancement over the right hemisphere. As expected the spatial location of the experiences were along the left upper visual fields. When bilateral LTP-patterned magnetic fields (the type that interferes with acquisition) were applied with equal intensity bilaterally his accuracy was reduced. The magnitude of the energy associated with this field was with the range of operating magnetic field strengths generated by the brain itself.

Our measurements also indicated that when he "reads" another person there is a change in the earth's magnetic field particularly along the right side of his head. In the single study where a person sat approximately 5 meters in front of him, the congruence of fluctuations in the magnetometers adjacent to the right hemispheres of SH's and the subject's head increased as the duration of the reading increased. The convergence was also associated with the increased perceived accuracy of his comments.

The physical mechanism by which SH's brain accesses the energy that contains the information from which his images and statements are constructed may be very fundamental. The mediation of information by patterns of photons literally opens the universe to a cerebral organization that has the congruency to discern the patterns and interpret the meaning. Because both of these properties (pattern detection and attribution

of meaning) are cerebral functions, there will be limitations with respect to processing rate and hence total information that can be sampled during any given percept of a set of energy functions that could define a particular individual's life-time experience and history.

The recent observation and calculations (Tu *et al.,* 2005) that a photon displays a threshold rest mass in the order of 10^{-52} kg and the velocity changes depending upon the frequency of the photon indicates that information from distant sources could affect, influence, and even be the source of visual experiences. Bokkon's (2005; 2009) ingenious hypothesis that retinotopic stimulation of the visual cortices stimulates cytochrome oxidase (which modulates the transfer of single electrons to oxygen molecules to a rate of about one every 10 to 20 msec) and related redox pathways to produce photon emission during action potentials has significantly changed the interpretation of the feasibility of information acquired from great distances through non-traditional senses. He argues that the visual experiences of dreams and even normal visual responses within the cerebral cortical manifold are patterns or "pictures" of photon emissions.

The value of 10^{-52} kg is also relevant because it converges with the energy values of the spin (magnetic moment) of an electron (9.28747×10^{-24} J/T) and the lower limit for estimations of the operating magnetic field intensity of the cerebral cortical manifold which is about 1 pT (1×10^{-12} T). The resulting energy is 9.28747×10^{-36} J the mass equivalence for which is 1×10^{-52} kg. The mass limits of the photon within the MHz to micrometer range would require a range of intrinsic magnetic fields between the pT to the microTesla range. The involvement of spin magnetic moment and the correlative fourth quantum number has implication for both entanglement and location within space-time (Hu and Wu, 2006).

That the hippocampus generates photons in the order of 10^{-11} J or 10^{-12} W/m^2 has been shown experimentally in the rat brain (Isojima *et al.,* 1995); the intensity of the photon emission is coupled to the theta frequency. Recently Dotta and Persinger (2010) found that normal volunteers generate photons with intensities less intense than SH from the right side of their heads. If these photon patterns were systematically related to neuronal activity associated with specific information or even the percipient's visual experiences and SH discerned them according to the principles of stochastic thresholds and signal/noise ratios, then a possible mechanism might be tested. A right hemispheric primary source for the experient and the detection by SH could accommodate the primarily emotional themes that dominate his accuracy.

The interface between patterns of photon energy and neural cell membranes, the first step in the process to contribute to the phenomena of consciousness and imagery, is quantitatively congruent. The time required for a photon moving at the velocity of light to pass through a neuronal membrane 10 nm (10^{-8} m) in width is about 10^{-16} s. This is the time required for one complete rotation of an electron around a Bohr atom. Stated alternatively, this is the same duration required for the energy and information of the photon to be represented in once cycle or closed loop of an electron's revolution which effectively determines the value of the Bohr magneton.

There are several neuroquantology implications that arise from this quantitative convergence. First, the actual value for Planck's constant of 6.6241×10^{-34} J s upon which estimates of energy from frequency and wavelength are derived is related to a single orbital rotation. Both the coefficient and the order of magnitude of the product of the energy equivalence (4.33×10^{-18} J) of the classical electron mass multiplied by the square of the fine structure (1/137 the velocity of light) approximates Planck's constant for the period of 1 revolution (1.53×10^{-16} s). Consequently the essential unit from which the quantum of energy is derived is related to a unit mass-energy equivalence of the electron and the time required for a photon to penetrate a membrane.

Second, for the well known difference between the width of the classical electron ("particle") and its corresponding Compton wavelength to occur would require a difference of .9999995 c (Persinger *et al.,* 2008c). The difference between energy equivalences of a transitional electron mass shifting between these two velocities is in the order of 10^{-20} J, the essential quantum unit of

the action potential. This quantum is released as biophotons from the membrane of cells, including neurons, during changes in potentials. Consequently the convergence of values for the action potential, which is often considered the biophysical unit of thought, and the shift between wave (energy) and particle would potentially allow both exchange and representation of information. There are multiple non-biological physical models that have shown that information storage and retrieval can be achieved through quantum phase analyses (Ahn *et al.,* 2000).

Third, the involvement of photons as the fundamental mode of interaction allows the operation of entanglement (Aczel, 2002). Shared photon emission and absorption between people would allow a persistent space-time connection for the duration of the organization unit, in this instance the person's life (Dotta and Persinger, 2009). If SH's brain discerns these photons through conditions that are correlated with increased electroencephalographic coherence between the right hemisphere of the experient and his unique brain organization, then he would, theoretically, have access to the information from people not present. That entanglement may occur microscopically has been suggested experimentally (Persinger *et al.,* 2008b).

Fourth, the energy increases associated with the Harribance effects were in the order of 5×10^{-11} J. The equivalent frequency, from J=hf, is 7.5×10^{22} Hz. The wavelength for a packet of energy moving at the speed of light would be 3×10^{8} m/s divided by that frequency or 4×10^{-15} m. This order of magnitude and coefficient are approaching the space occupied by the width of the classical electron and proton.

The second operation involves the representation within an extracerebral space of the information associated with the electromagnetic phenomena associated with brain function. According to Persinger (2008) during the approximately 20 to 30 min (1 to 2 ksec) period of electrical lability associated with the representation of experience within the human brain, before the patterns are consolidated as protein sequences and growths of dendritic spines, there is a simultaneous representation of the information within the space occupied by the earth's magnetic field. Whereas the upper limit for information representation within a single person's brain is bound by the approximately 10^{13} synapses within the cerebral cortices, the information represented in the geomagnetic space would be limited only by its energy capacity.

Assuming the average neuron's activity is 10 action potentials per sec, the energy associated with each action potential is 10^{-20} J, there are 10^{11} neurons (including those contributing to the cerebral cortices) and a person lives for about 2×10^{9} s (about 68 years), the total life time energy associated with the electromagnetic patterns for all of the person's thoughts would be 10^{1} J. The potential energy that can be stored within the earth's magnetic field, even by simply multiplying its dipole moment of 8×10^{22} A m^2 by its average intensity of 5×10^{-5} T (0.5 gauss) is 4×10^{18} J. This means that there is sufficient energy within the space occupied by the earth's magnetic field to store *all* of the information associated with all of the action potential-related energies generated by every human being who has ever lived.

The most likely functional connection between the earth's magnetic field and each human brain would be within the 7 to 8 Hz range, and its harmonics (particularly 40 to 45 Hz), of the Schumann resonance that is generated fundamentally within the spherical wave guide created between the earth's surface and the ionosphere. Even the electric (mV) and magnetic field (pT) strengths within the Schumann series (Konig, *et al.,* 1981) are the same order or magnitude as those generated within the human brain. With an overall capacitance of 2 Farads and an inductance of 1.6×10^{2} Henrys (Webers/amp) for the geomagnetic surface-ionosphere interface the time required for a 7 Hz signal to be represented (both theta and Schumann resonance frequency) is about 30 min. This is also convergent with the asymptote (about 3 times the discrete solution) of the current decay between the earth's surface and the ionosphere which can be obtained by dividing the permittivity of space (8.85×10^{-12} F/m) by the average conductivity of about 2×10^{-14} S/m.

From this perspective, SH's personal experiences of "*projecting to the book*", which might be considered a variant of "*accessing the Akashic*" record, may have some validity.

The information would be manifested in a form that is representable in his brain space. It would be equivalent to the perception of a three dimensional picture on a computer screen that is essentially a two dimensional aggregate of digital pixels.

One would expect the precision and control of SH's non-locations to be variable and not maximum. If the mechanism that maintains the information operates within the quantum time level and the increment of neurocognitive detection is within the 20 msec range, then the experiences SH reports should range from the general to the very specific and cross the entire time-line (with a normal distribution around the present frame of reference) of the person. This is what people have reported about his statements. The more accurate statements were associated with relatively unique states of space-time brain activity. Metaphorically, his experiences would be similar to repeated, random opening of a large book containing all of the information on a person's life with only enough time to view one or two sentences on a page.

If becoming aware of our conscious experience is due to the delays between incoming patterns of signals before it matches a previously established outgoing pattern (Pribram and Meade, 1999), then the organization of SH's microstates would allow more rapid and frequent sampling than the average person. Larger numbers of temporal samples would increase assimilation that would lead to accommodation with qualitatively different patterns of organization. The interhemispheric organization and his history of relating these experiences with their consequences would have strengthened and validated the associations between what he "sees" during his projections and what has happened as verified by the people with whom he interacts.

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