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Research Note: Sleeping With the Entity – A Quantitative Magnetic Investigation of an English Castle's Reputedly 'Haunted' Bedroom.

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Abstract

Field-based investigations of haunt-phenomena have revealed that magnetically remarkable signatures may exist in specific locations associated with strange experiences. However, no field-study to date has carried out a detailed assessment of both magnetic frequency and amplitude components present in such environments. In the present study, we carried out a follow-up investigation that further examined a recently documented magnetic anomaly from a reputedly haunted English castle. We report the first field-based investigation of amplitude and frequency-based (FFT) analyses of a magnetically remarkable microenvironment associated with repeated instances of striking anomalous experiences. Both the existence of a large static inhomogeneous magnetic field and complex temporal distortions in the time-varying (AC) magnetic fields were measured. Implications for anomalous perceptions are discussed.

Introduction

Recent research suggests that locations associated with repeated instances of haunt-type experiences may contain magnetically remarkable

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signatures (Braithwaite, 2004; Braithwaite, Perez-Aquino, & Townsend, in press; Wiseman, Watt, Greening, Stevens, & O'Keeffe, 2002; Wiseman, Watt, Stevens, Greening, & O'Keeffe, 2003; see Persinger & Koren, 2001). Under certain circumstances these locations may influence specific neural/experiential processes in certain individuals. The net result of exposure to such fields could be that observers may subsequently bias their impressions of ambiguous stimuli towards a paranormal interpretation within a particular 'magnetic context' (see Houran, 2000; Lange & Houran, 2001, 1997[1]), or indeed such fields may induce more elaborate forms of direct sensory hallucination (see Persinger & Koren, 2001).

However, despite the useful nature of these studies it is still somewhat unclear as to what is both necessary and sufficient for a magnetic environment to contain experience-inducing characteristics within certain contexts. This is particularly the case in terms of detailed time-varying and frequency-based components of magnetic signatures. If we accept the general working hypothesis that magnetic signatures can be crucial, then we need to start asking more detailed questions about the signatures and contexts themselves. One possibility is that what is both necessary and sufficient for a particular magnetic field to exert an influence in one context, is the same for most other contexts. Alternatively, it could be that these factors vary dependent on other context-dependent contributions present at that time (either related to the individual or the environment). Irrespective of the possibilities, assessing the magnetic microenvironment is now a task of major importance for the field-based investigation of a reputed haunting.

The present study

We returned to investigate a reputedly haunted English Castle. The location was Muncaster Castle situated on the west-coast of the lake-district (see Braithwaite, 2004; Braithwaite et al, in press). In previous studies we have shown that areas associated with striking haunt-type reports, were also distinguishable along magnetic dimensions – with crucial areas showing much increased variability. One area of importance identified for both eyewitness accounts and magnetic anomalies

[1] We acknowledge that magnetic fields themselves are not the only variable with the potential to influence perceptions in observers. Many other physical dimensions and contextual factors may contribute and even predominate in certain cases. Nevertheless, striking experiences do seem to be associated with magnetic signatures and we concentrate on this component here.

is the Tapestry room bed (see Table 1 for a summary of the most striking reports). However, previous investigations were unable to assess how the magnetic variability was being shared across complex time-varying sources, localised static DC sources, or interactions between the two. The purpose of this return visit was to initially assess in more detail (i) the nature of the static distortions, (ii) the nature of the time-varying amplitude and frequency components, and (iii) basic interactions between static and time-varying components.

Table 1: A summary of some of the main experiential components reported by Tapestry-room bed occupants

Content of experience / reports from some occupants of the Tapestry room bed
Sounds of children crying / screaming
Sounds of adult voices
Feelings of a sensed presence / being watched
Fleeting visual shadows / apparitions
Hearing footsteps – bangs and raps
Bouts of ringing in the ears
Severe headaches / migraine
Being touched in the night
Bouts of dizziness
Periodic feelings of severe foreboding
Feelings of a weight on the chest / body pressing down

Method

Design & procedure

The study was carried out at Muncaster Castle, Ravenglass in West-Cumbria on the evening of Tuesday the 26th October, 2004, between 7:00pm and 11:30pm. We carried out a preliminary magnetic survey of the Tapestry room (TR) bed using a Silva navigational compass, which was repeatedly passed over and around the bed area. This was then followed up by taking a series of precise measurements using the Magnetic Anomaly Detection System (MADS) which employs two separate digital fluxgate magnetometers interfaced directly to laptop computers. To do this we divided the bed up into 3 discrete reference points placed along a central dividing line. These were (i) the pillow area, (ii) the middle of the bed, (iii) the foot of the bed. One sensor (Sensor A) was placed on the pillow and remained there for the whole experiment. The other sensor (Sensor B) was moved to the different bed reference points and produced a series of time-linked synchronised magnetic measurements from those locations. We also ran two separate baseline estimates which included (i) a condition measuring the pillow with all the lights turned off to assess how the nearby bedside lamps, and their demand on the AC power supply were contributing to the overall AC magnetic fields measured (no-lights), and (ii) a mid-room measurement which represents an area localised to the bed, but existing outside of any static anomaly (as determined by prior surveys and repeated here by the compass survey). The approximate mid-room point was located 3 – 4 m distance from the TR bed. Each location was measured for 10mins duration. All frequency-based and FFT analyses were carried out using Sigview signal analysis software (http://www.Sigview.com/).

Frequency-spectrum analysis (FFT/STFT) configuration

The time-varying components of the amplitudes measured were separated by applying Fourier Transforms to the data. We carried out two separate forms of Fourier Transform. Firstly, we applied a standard frequency-only Fast Fourier Transform (FFT) on complete 10 min sessions. This revealed how much of the magnetic energy was contained within what major frequency components (between DC – 125 Hz). Coupled to this we also carried out a Short-Term Fourier-Transform (STFT) based on a 'moving window' approach where peak amplitudes were measured at discrete temporal intervals through the signal. Furthermore, a Short-Term Fourier Transform analysis which provided a time – frequency and amplitude representation of the fields measured was also carried out. This showed not only what frequency components were present, but also when in time they occurred and to what magnitude.

Results

The compass test revealed a strong deflection in the magnetic field around the bed. The compass needle was being considerably deflected by the bed up to a distance of around 2 metres, this deflection being more than 90 degrees close to the iron mesh bed support itself. This indicates a strong localised static anomaly[2].

Results from the MADS bed-survey were as follows: Firstly, there were large differences between the overall static DC fields measured at

[2]The beds in nearby rooms showed no magnetic reaction at all when tested.

the three bed reference points. Overall mean amplitude levels are given in Table 2 along with their associated standard deviations (as an index of variability). Turning the lights off had only a minimal impact on the measured amplitudes indicating that they were not a crucial contributor to the background ambient magnetic environment in the bed area.

Table 2: Mean field strength (static amp) and standard deviation for each measuring session during the bed survey and baseline measurements. Note; low-load measurements were taken in the pillow region with all the room and bedside lamps turned off.

Sensor Location (A)	Static amp (nT)	Std-dev	Sensor Location (B)	Static amp (nT)	Std-dev
Pillow area	23,144	24	Bed centre	93,013	61
Pillow area	23,145	24	Bed foot	57,202	109
Pillow area (no lights)	23,143	24	N / A	-	-
Mid-room	74,021	22	N / A	-	-

Standard FFT

A visual examination of the fields measured was carried out to reveal any peaks, transient AC events, DC shifts, or any time-based variability within the data series (see Figure 1). After inspection (which did reveal some anomalies – reported below) we applied a FFT to the 10min data series on the Total combined ($\sqrt{x^2 + y^2 + z^2}$) data for every sensor location. The predominant AC component (Figure 1) across all locations surveyed was found to be primarily a 50 Hz waveform (UK mains-frequency), when confirmed using a FFT (Figure 2). Note, there is a difference in amplitudes between the raw AC variability and that shown in the FFT peak. This is because not all the energy is exactly 50 Hz, at all times. Due to an odd modulation effect (discussed below and shown in Figure 4) this often caused instances of frequency spreading around the base of the peak (e.g., estimates of 48 Hz – 52 Hz).

As the measurements were taken within a living environment that had electrical wiring the presence of a 50 Hz peak is not surprising and should be an expected contribution to some degree. The 50 Hz averages for the whole measuring session at each location, along with their associated standard deviations are shown in Table 3.

Short-Term FT (STFT) analysis

We compared the variability at the various bed-reference locations to the respective time-linked matched baseline measurements. Firstly,

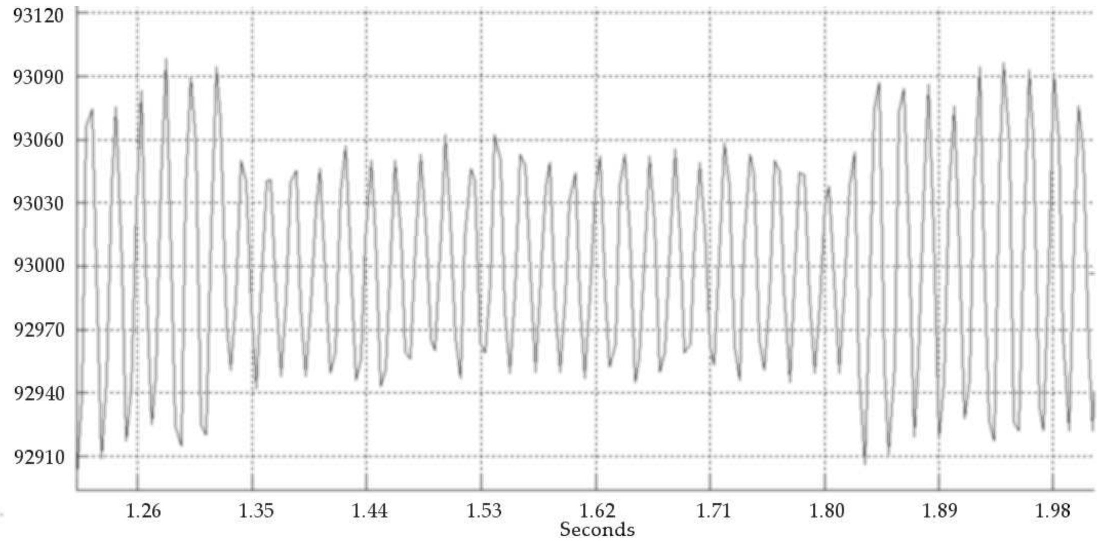

Figure 1. An example of the raw waveform magnetic time-series data measured at 250 samples a second by Sensor A (bed centre session). This specific illustration shows an 'inverted pulse' instance. The clear difference between the pulse and the general background variability can be easily seen (values given in nT).

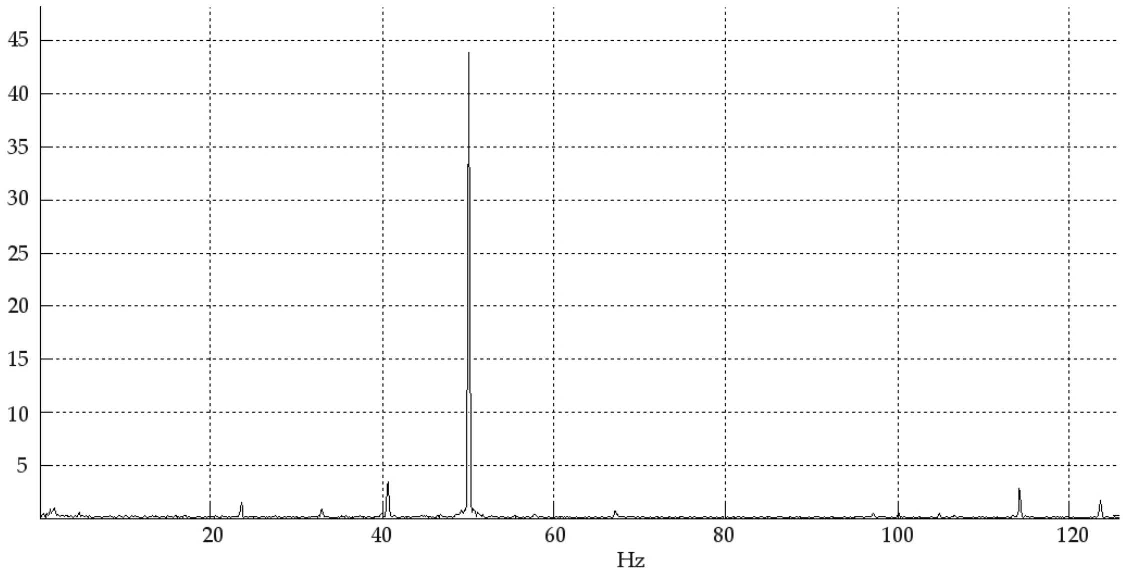

Figure 2. An example of the time-series magnetic data converted into the frequency domain via an FFT applied to the data series (from the first 8 seconds of the bed centre session). The frequency spectrum between DC –125Hz is shown. Here a clear 50Hz peak of approximately 44nT can be seen. This represents the contribution from artificial man-made wiring to the background fields measured. This figure shows how much magnetic energy is contained within what frequency components.

Table 3: Total average 50Hz frequency amplitudes measured via the FFT procedure for each sensor location. All values are given in nT.

Sensor Location (A)	50Hz amp (nT)	Std-dev	Sensor Location (B)	50Hz amp (nT)	Std-dev
Pillow area	15.1	1.2	Bed centre	39.1	3.1
Pillow area	15.4	1.2	Bed foot	26.1	9.3
Pillow area (low-load)	15.9	0.7	N / A	-	-
Mid-room	9.9	1.4	N / A	-	-

we computed a moving-window STFT on the combined values and moved through each signal in steps of 30 seconds (approx 7500 samples[3]) to create a series of 'amplitude bins' (note these amplitudes only refer to the energy contained within the 50 Hz frequency spike). At every 30 sec bin, we recorded the peak 50 Hz amplitude measurement (in nT). Each sensor run for each location produced 20 amplitude bins. We then compared and analysed the differences between the locations by calculating the variance for each data set and dividing these into each other to produce an F-Max value (a derivative of the F-ratio when unequal variances are suspected: Keppel, Saufley & Tokunaga, 1992), which is then compared to an adjusted P-value. This revealed the following results. The variability measured in the bed-centre was significantly more increased relative to the time-linked measurements from the pillow-area, $F_{adj(19,19)} = 6.67$, $p < .01$. The bed-foot was also significantly more variable than time-linked measurements from the pillow-area, $F_{adj(19,19)} = 60.10$, $p < .001$. We also compared the "no-lights" pillow measurement against the average of the two pillow sessions that had the lights on. Although there was a trend for a marginal reduction in variability, this difference was not significant, $F_{adj(19,19)} = 2.94$, $p > .025$. Finally, we averaged the variability for all three bed-grid positions (as a general representation for variability in that area) and compared this to the mid-room baseline location. The variability in the bed region was significantly increased relative to the mid-room baseline area, $F_{adj(19,19)} = 16.8$, $p < .001$.

[3]Due to concerns from an 8 second modulation effect we repeated the above analysis with a moving window restricted to 8 seconds bins that moved in phase with the effect. This meant that in most cases each 8 second bin contained data that was, as much as possible, stationary within itself. Although the size of the effects altered slightly, the relative difference between the results remained unaltered.

Visual Analysis of 'inverted-pulse' events

Moving through the signals, the visual analysis revealed what appeared to be a number of 'inverted pulses' (see Figure 1, for a typical example). These pulses were present at all locations surveyed, and occurred throughout the measuring period (though they varied considerably in amplitude at different locations). In all cases the pulses displayed the same characteristics, consisting of a sudden, large drop in the AC field component, returning to its previous value. The average pulse duration was approximately 480 ms for all locations. The pulses appeared at the same time in the matched data files from both locations in each synchronised pair. Therefore, whatever was causing the pulses, its influence was affecting all the locations measured. The waveform frequency during the pulse remained at 50 Hz, the same as the AC waveform surrounding it. It was also immediately apparent that the pulses occurred at intervals that were integer multiples of approximately 8 seconds.

In Figure 3 the frequency of each multiple of 8secs gap is plotted. The leftmost column is the number of 8sec gaps (the most frequent), followed by 16sec gaps, then 24sec etc.

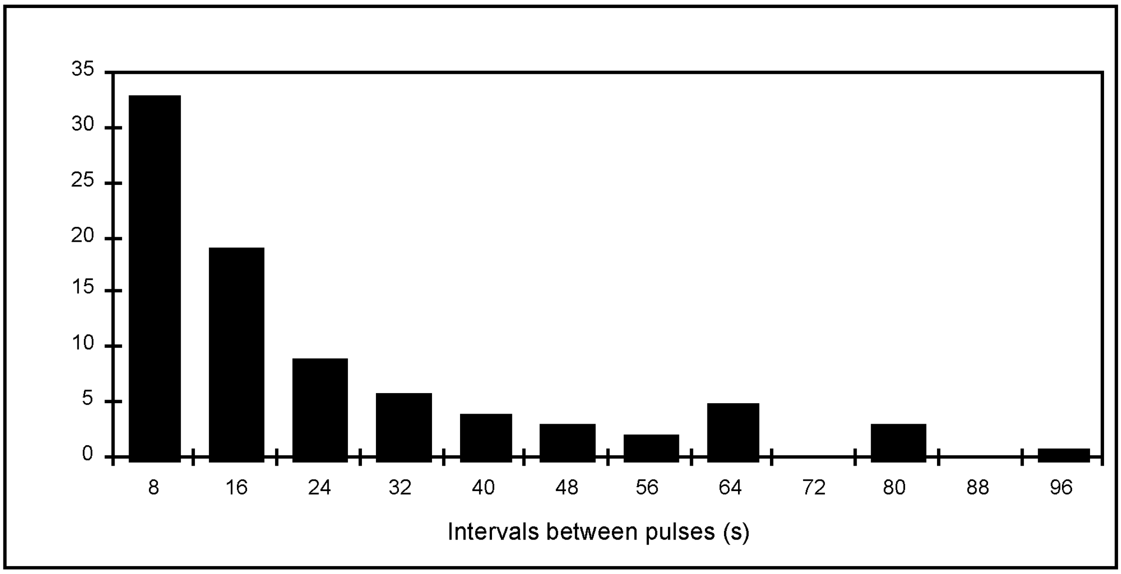

Figure 3. A frequency-plot of each multiple of 8 secs gap. The leftmost column is the number of 8 sec gaps between pulses (the most frequent), followed by 16 sec gaps, then 24 sec etc.

The degree of change between the AC pre-pulse and AC during-pulse amplitude differences were also calculated. The change in amplitude during the pulse (the 'pulse depth') is defined here as the average

AC amplitude over the 500 ms preceding the pulse minus the average amplitude during the pulse. The pulse depth is important because it represents a sudden change in the energy contained within the overall 50 Hz field. Table 4 shows the average amplitudes before and during the pulses, as well as the depth (i.e., difference), for each pulse.

Table 4: Amplitude inverted-pulse characteristics measured by both sensors at the same time. These values (nT) represent average amplitudes collapsed across all pulse instances

Sensor Location (A)	Pre-pulse amp	During-pulse amp	Pulse 'depth'	Sensor Location (B)	Pre-pulse amp	During-pulse amp	Pulse 'depth'
Pillow area	20	7	13	Bed centre	76	45	31
Pillow area	30	15	15	Bed foot	71	49	22
Pillow area	30	14	16	Mid-room	25	14	11

Table 4 shows that the highest AC fields, occurred at the bed foot and bed centre locations. These same areas also saw the largest pulse 'depth'. On occasion pulses easily exceeded 40 nT. This suggests that these areas may well be closer to the source of the pulse effect, since the depth of the pulse should increase with increasing proximity to the source. It is clear that apparent depth varies in proportion to overall AC amplitude.

Time-based STFT:

Consistent with the moving-window STFT analysis reported above, we also carried out a time-STFT plot on the data series which reveals more vividly that the energy contained within the 50Hz peak was not constant, but varying over time . The example given in Figure 4 shows a segment from a measuring period taken from the bed-centre location. The 50 Hz peak that makes up the principal component and general waveform can clearly be seen as an obvious ridge in amplitude. In addition, as one traces the ridge across time, four large amplitude drops or 'notches' can be seen. Furthermore, in phase with these notches the 50 Hz peak did display some minor frequency-spreading and distortion at the base of the peak. The illustrated segment represents pulses that seemed to display an 8 second interval pattern. The overall duration represented in Figure 4 is approx 30 seconds worth of data.

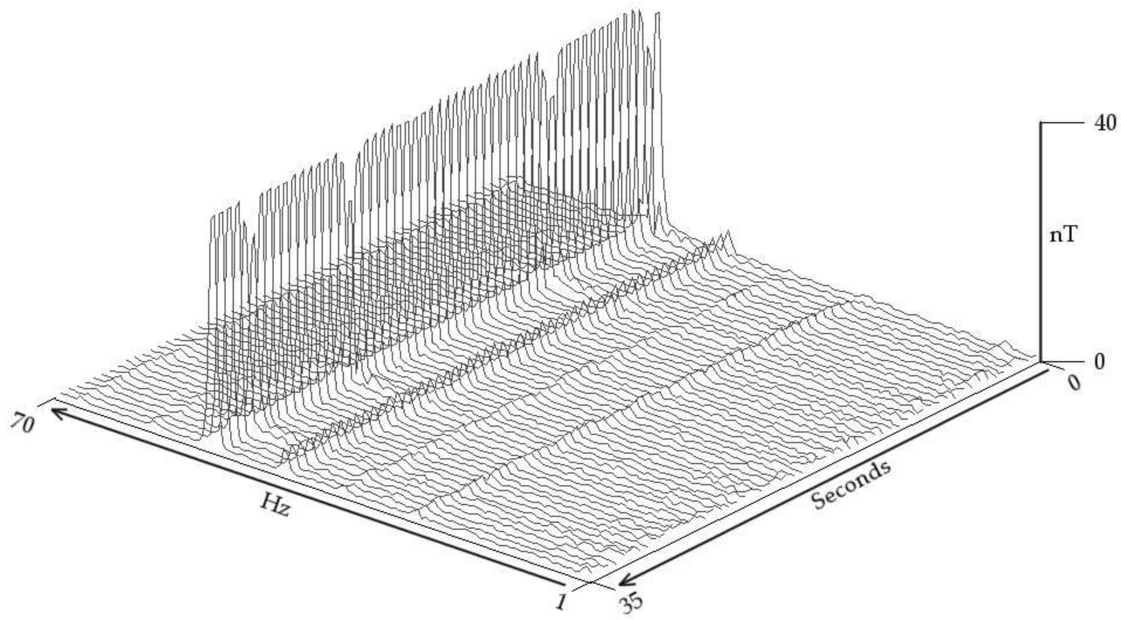

Figure 4. Data from an STFT showing a time-frequency representation of the magnetic fields measured. Frequency is represented along the x-axis (1 – 70 Hz) and shows a clear large ridge or peak at 50 Hz. Time is represented along the y-axis (0 – 36 sec) and amplitude is represented along the z-axis (max 40 nT). As can be seen the 50 Hz field is present throughout the measuring period. However, now plotted over time, a number of inverted pulses in the amplitude can also be seen. This procedure reveals not only what frequencies are present, but also how long they are present for (continuous or sporadic) and displays any temporal discontinuities in the magnitudes of the fields present (as can be seen in the 50 Hz ridge over time).

Discussion

We returned to an English castle to investigate both the static and time-varying (frequency) components of a particular magnetic anomaly previously implicated in a reputed case of a haunting. The present findings extend prior measurement studies by including here an evaluation of both the natural magnetic and the spectral components present during the measurement period. The nature of this anomaly and its experience-inducing potential are briefly discussed below.

Static magnetic field distortions

The largest contribution to the localised anomaly is clearly a static field. This static ambient magnetic field is distorted in a major way (see Table 2). The largest distortion found was over 70,000 nT, implying that the metal mesh may well be magnetised and not just highly permeable. The large static field variability between the bed areas surveyed and the rest of the room will result in high magnetic gradients around and across the TR bed. If an occupant of the TR bed were to move their head frequently in such a steep magnetic gradient it could potentially induce highly variant magnetic distortions around their skulls. The distance from the pillow and the centre of the bed is around 1 m. Based on estimations from the present data, there is an implied gradient of at least 70 nT/mm. Thus, relatively modest movements in either the head of someone on the bed or of the metal mesh itself would easily expose the head to changes well in excess of 100 nT.

Varying Magnetic Fields

The main contribution to the ambient AC field is overwhelmingly coming from a 50 Hz power-frequency source. In contrast to the static anomaly, the AC contributions to the general TR area are low – on average being less than, 30 nT. However, the level of this amplitude was varying considerably over time. One possibility for the pulses in amplitude could be phase modulation. Interestingly, the castle employs a 3-phase power system in which the phases are separated by 120 degrees. The presence of a 3-phase system certainly increases the likelihood that the modulation effect could indeed be due to separate 50 Hz magnetic contributions that are out of phase with each other. For phase modulation to *reduce* an ambient field of the same frequency, it would need to be out of phase by over 120 degrees. This possibility requires further examination.

There are no discernable patterns to the gaps between pulses though clearly the shortest intervals (8 seconds) are the most frequent (Figure 3). The relationship between gap frequency and interval is striking. The largest pulse depths are around the foot and centre of the bed (Table 4), implying that the source is physically nearer to those areas.

In terms of haunt-type experiences, the pulses are interesting because of their very low-frequency (up to 0.125 Hz) and amplitude (the largest drop recorded was over 40 nT). For instance, other research has suggested that low-frequency signatures (in the region of the brain activity from 0.5 – 40 Hz) are particularly potent for encouraging neurophysiological shifts and experiential changes in individuals (Bell, Marino, & Chesson, 1992; 1994; Randall & Randall, 1991; see Persinger & Koren, 2001). Such a low-frequency is also well within the same range of natural geologically defined fields which have also been suspected in some anomalous reports (Persinger, Ludwig & Ossenkopp, 1973; see Persinger & Koren, 2001; Roll & Persinger, 2001). Furthermore, magnetic field variability as low as around 11 nT – 15 nT has been associated with increased strange perceptions reported in some field studies (Wiseman et al, 2003; Stevens, personal communication). The magnetic variability contained simply with the 50 Hz component here is well in excess of those suggested estimates (irrespective of the variability coming from the static anomaly of the bed itself).

Though the pulses are created out of a 50 Hz field (which is not a complex field) it would be 'seen' by a DC magnetometer, and by a human brain, as a pulse in the static field. Importantly, the non-homogeneous nature of these pulses, varying in time and magnitude do share some similarity to the artificial signatures employed in laboratory studies. The natural and spontaneous characteristics of a specific area (the TR bed) are associated with field signatures very similar to those associated with physiological changes (Persinger & Koren, 2001) and experiential reports (Wiseman et al. 2002, 2003).

How could these anomalies underlie the haunt reports?

Occupants of the TR bed are clearly immersed in a strong, static, spatially inhomogeneous and a temporally variable complex magnetic field. The variability of the fields would be greatly exaggerated by movement within the bed. The distortion in the static field caused by the magnetic bed support occurs independently of and is in no way related to the electrification of the castle. Individual movement by bed occupants would induce vast time-variant and complex changes in the fields directly surrounding the individual. Therefore, time-varying changes can occur here in the complete absence of any electrical supply or equipment and, as such, does not need a power source in order to produce significant distortions.

Secondly, on top of this, additional low-frequency AC ripples in the base 50 Hz field also add further temporal complexities to the magnetic signatures available. Indeed, even what should be the most basic magnetic field (a 50 Hz component) is far from displaying simple properties. The fact that these anomalies are most prominent in an area where occupants spend some time before reporting experiences is in line with the suggestion that such fields are associated with striking reports of anomalous experiences. The nature and amplitude of this distortion are similar to those reported from both other laboratory studies and field-based investigations of haunt-type reports. Although many factors may contribute to different instances reported from the TR (both individually and environmentally) the excessive nature of the magnetic distortion in that precise region may not be a coincidence.

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