

# Environmental Sensitivity and Paranormal Experiences

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## **Abstract**

The physical environment affects every individual differently, however past research suggests that certain individuals exhibit a greater susceptibility to environmental factors than the general population (Jawer, 2006). According to Jawer (2006) these environmentally sensitive individuals are also significantly more likely to report paranormal experiences than non-sensitives. The current study set out to test the hypothesis that environmentally sensitive individuals will report more past paranormal experiences as well as more haunt-type experiences in a natural setting. The study also looked at whether subtle differences in electromagnetic fields (EMFs) led to an increase in reported haunt-type experiences among sensitives. *Methods:* Participants (N=251) completed a questionnaire which categorized them as either environmentally sensitive or non-sensitive and were then led on a guided tour of an allegedly haunted location where they reported any unusual phenomena that they experienced. EMF readings were taken of the rooms visited on the tour and based on those readings the rooms were either designated as 'High EMF' rooms or 'Low EMF' rooms. *Results:* Sensitives reported significantly more past paranormal experiences and haunt-type experiences in a natural setting. Overall there were significantly more haunt-type experiences in 'High EMF' rooms than 'Low EMF' rooms suggesting an association between increased EMFs and reports of haunt-type experiences. Further analysis showed that sensitives reported significantly more haunt-type experiences in 'High EMF' rooms than 'Low EMF' rooms; however there was no significant difference in reported experiences between rooms among non-sensitives which suggests that sensitives could be picking up on subtle EMF differences leading to an increase in reports of haunt-type experiences.

## Introduction

As humans we are affected by and react to the environment in different ways. It has been suggested that the physical environment affects certain individuals more than others, which may lead to varying environmental conditions and dysfunctions (Jawer, 2005, 2006). According to Jawer (2006) these individuals would be categorized as environmentally sensitive. Past research points to environmental sensitivity as a neurobiological phenomenon by which certain individuals, from birth onward, are capable of registering very slight differences or changes in the physical environment and are inclined to a number of conditions, illnesses, and perceptions that in novelty as well as intensity distinguish them from the general population (Jawer, 2005, 2006). Environmentally sensitive individuals commonly report longstanding allergies, chronic pain and fatigue, depression, migraines, or sensitivity to light, sound, and smell (Jawer, 2005, 2006). Environmentally sensitive individuals were also more likely to report that their immediate family members suffered from the same conditions, which raises the possibility that environmental sensitivity has a genetic predisposition (Jawer, 2006). Those who were found to have heightened sensitivity to the environment or who were deemed environmentally sensitive were also found to report significantly more paranormal and apparitional experiences (Jawer, 2006). Paranormal experiences encompass a broad range of phenomenon which in one or more respects exceeds the limits of what is deemed physically possible on current scientific assumptions. For the purposes of this study it will be used as it is in most parapsychological research to describe experiences (i.e. telepathy, extra-sensory perception, psychokinesis, hauntings) that are outside the realm of human capabilities as presently conceived by conventional science (Irwin, 1999). Apparitional experiences refer to specific reports of ghosts or apparitions. The next section will discuss research highlighting individual differences in sensitivity as well as present evidence suggesting that these differences have a biological origin.

The idea that we all experience the physical environment differently is not new, however recent research suggests that the differences regarding how individuals experience the physical environment have a biological origin (Coghlan, 2001; Hollingham, 2004; Menashe, Man, Lancet, & Gilad, 2003). For example, women exhibit markedly greater sensitivity across all senses (Velle, 1987, as cited in Jawer,

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2006). Females have been shown to exhibit greater sensitivity to smells than males (Brand & Millot, 2001) as well as colour perception, with certain females displaying enhanced colour vision due to chromosomal variants (Hollingham, 2004). Olfaction also seems to vary among cultures. Out of 1,000 olfactory genes 600 are pseudogenes, which are inherited like genes however were recently thought to have lost their function (Menashe et al., 2003). These pseudogenes were recently discovered to still function in certain individuals as studies suggest that each person has a unique combination of functioning pseudogenes, giving them an individualized repertoire of smell receptors with African-Americans having significantly more functioning olfactory sensors (Menashe et al., 2003). The perception of pain is also markedly different among individuals. Coghill, Haffie, and Yen (2001) provided evidence of a correlation between the amount of pain reported and the amount of brain activity in fMRI studies. The least sensitive group displayed modest brain activation whereas the highly sensitive group displayed robust activation. According to Coghill et al. (2001) “these results provide a compelling neurophysiological correlate of differing subjective experiences of pain produced by an identical sensory stimulus.”(p.425)

The idea that certain people are seemingly predisposed towards extraordinary sensitivity has led to research that has uncovered overlaps between environmental sensitivity and certain physical conditions (Jawer, 2005, 2006). Conditions such as migraines, fibromyalgia, irritable bowel syndrome (IBS), chronic fatigue syndrome, and asthma/allergies all have an overt association with environmental sensitivity and are also linked with depression, more prevalent in women (with symptoms getting worse during menstruation), and have genetic predispositions. Overlaps among migraines, fibromyalgia, IBS, and chronic fatigue syndrome have lead researchers to suspect that these conditions have a similar neurobiological basis, which leads to hypersensitivity (Center for the Advancement of Health, 2001; Jawer, 2005, 2006). The next few sections will look at each physical condition separately pointing out their overt associations with environmental hypersensitivity and possible neurobiological origins as well their links with depression, gender prevalence, and genetic predisposition.

One condition that is linked with heightened sensitivity to the environment is migraines. Some of the symptoms of migraines include increased sensitivity to environmental stimuli such as light, sound, and smell (Migraine Action Association, 2008). Environmental hypersensitivities are not only symptoms of migraines but are

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also one of the leading triggers of migraines. Environmental triggers of migraines include; bright light, flickering/flashing light, loud noise, intense smell, changes of weather/climate, smoking, and stuffy atmospheres (Migraine Action Association, 2008). Recent studies have suggested that those with migraines have a more sensitive nervous system than most. (Bahara, Maitharu, Buchel, Frackowiak, & Goadsby, 2001; Bigal, Ashina, Burstein, Reed, Buse, et al., 2008). Researchers from Massachusetts General Hospital also found that the somatosensory cortex of the brain was up to 21% thicker in migraine sufferers, which they suggest could lead to migraine sufferers being hypersensitive to stimuli in general (BBC News, 2007). According to Dr. Hadjikhani (as cited in BBC News, 2007) “it’s possible that people who develop migraines are naturally more sensitive to stimulation.”(p. 1) Dr. Hadjikhani goes on to suggest that this hypersensitivity may help explain “ why people with migraines often also have other pain disorders such as back pain, jaw pain, and other sensory problems such as allodynia, where the skin becomes so sensitive that even a gentle breeze can be painful.”(p.1, BBC News, 2007) Bigal et al. (2008) also found that migraines sufferers are significantly more likely to suffer from allodynia (i.e. very sensitive skin) which can lead certain sufferers of migraines to find combing their hair, getting dressed and even putting on jewellery as intensely painful. Those who suffer from migraines are also more likely to be female with differences between sexes increasing dramatically during adolescence (Newman, 2007). Menstruation also exacerbates symptoms of migraines and allodynia as migraines are more severe and longer in duration (Newman, 2007) and brush-evoked allodynia is more widespread (Bigal et al., 2008). The most problematic symptom of migraines is intense and painful headaches and while the ability to detect pain is important in regards to protecting individuals from harming themselves in certain cases pain systems become too sensitive and cause one pain that has no benefit. Central sensitization, which is responsible for allodynia, is an increase in the excitability of neurons within the central nervous system (Woolf, nd.) This causes normal inputs to produce abnormal responses. It has also been suggested that fibromyalgia and IBS are also manifestations of abnormal sensory processing in the nervous system (Woolf, nd).

Fibromyalgia also known as chronic pain syndrome is often linked with IBS. The symptoms of fibromyalgia involve chronic widespread pain, fatigue, sleep disturbances, impaired concentration, memory issues, headaches, allergic symptoms, and hypersensitivity to environmental stimuli (odours, bright light, loud noises)

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(Buskilia & Sarzi-Puttini, 2006; Starlandyl, 2004; Winfield, 2007). Fibromyalgia sufferers also report that their symptoms are aggravated by changing weather especially humidity and barometric pressure (Starlandyl, 2004). Much like migraines, fibromyalgia is not entirely understood however the most recent evidence suggests that it is the result of a malfunction in the central nervous system ((Buskilia & Sarzi-Puttini, 2006; Winfield, 2007). Fibromyalgia is also reported to be more prevalent in females with a female to male ratio of 9:1 (Winfield, 2007). Women with fibromyalgia also report an increase of symptoms before and during menstruation (Ostensen, Rugelsjoen, & Wigers, 1997) There is also strong evidence suggesting a genetic predisposition as well as a link to depression (Buskilia & Sarzi-Puttini, 2006; Winfield, 2007).

While migraines, IBS, and fibromyalgia have been linked to a sensitive nervous system, allergies and asthma are linked with hypersensitivities in the immune system (Davies & Ollier, 1989; Sharon, 1998). Allergies and allergic asthma are caused by environmental substances known as allergens, which are generally harmless. Allergic reactions occur in response to harmless allergens that would pose no danger to the individual if they were not hypersensitive to them (Sharon, 1998). Different allergens produce different symptoms; however these symptoms are usually localized to the site of entry of the allergen. Common local allergic reactions include; hay fever, asthma, reactions to insect bites, and food/drug allergies (Sharon, 1998). Sensitivities to allergens vary considerably from person to person as it is possible to be allergic to a wide range of substances in the environment. The tendency to develop allergies is genetically inherited; however environmental factors also appear to be responsible for an increase in allergies (Davies & Oliver, 1989; Shallis, 1983; Sharon, 1998). Allergies and asthma are also significantly more prevalent in females from adolescence onwards (Shallis, 1983; Schatz & Camargo, 2004; Jensen-Jarolim & Untersmayr, 2008). Allergic diseases are also linked with menstruation and are reported to worsen during pregnancy in women suggesting a link with sex hormones (Jensen-Jarolim & Untersmayr, 2008). Shallis (1983) believes that the physical and mental stress associated with menstrual cycles and pregnancy on women lower their threshold-level of tolerance making them more sensitive and susceptible to irritants and allergens, thus exacerbating their symptoms.

The previous section has provided evidence suggesting that individuals possess differing levels of sensitivity to the environment. Evidence has also been

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provided linking environmental sensitivity with certain physical conditions such as migraines, fibromyalgia, IBS, chronic fatigue syndrome, asthma, allergies, and depression. The next section will introduce research regarding hyper-sensitivity to electromagnetic fields (EMFs) and chemicals as well as overlaps between the symptoms of these hyper-sensitivities and environmental conditions discussed earlier. EMFs are most often produced artificially by electrical power currents such as those found in homes and offices. When an electrical current travels through the wiring into an appliance, it produces an electromagnetic field, which consists of the electric field which is always present and the magnetic field (MF), which is only present when the power is turned on to the appliance. The next section will also discuss evidence that suggests a neurobiological origin to EMF hypersensitivity and a possible 'magnetic sense' possessed by all humans.

Electrosensibility (i.e. the ability to perceive or sense electric and electromagnetic fields), Electromagnetic hypersensitivity (EHS) (i.e. developing physical and mental health symptoms due to exposure to electromagnetic fields tolerated by the general population), and Multiple Chemical Sensitivity (MCS) (i.e. physical and mental health symptoms attributed to low levels of exposure to everyday chemical substances) are also considered environmental conditions (Leitgeb & Schrottner, 2003; Bailer, Rist, Witthoft, Paul, & Bayerl, 2004).

The symptoms of MCS and EHS overlap with each other as well as with other environmental conditions such as fibromyalgia, sick building syndrome, gulf war syndrome, migraines, chronic fatigue syndrome and allergies, which suggest that individuals with these conditions could share an overall heightened environmental sensitivity (Sanstrom, Lyskov, Hornsten et al., 2003; Jawer, 2006). Fibromyalgia patients also report Electrosensibility stating that they believe they can hear and feel electricity (Starlanyl, 2004). Starlanyl (2004) states that some have reported that "their brains seemed to be wound up by electrical storms, the full moon, auroras, and solar flares"(pg. 13). Starlanyl (2004) goes on to report how those with fibromyalgia often report that their presence effects street lights, VCR's, computers, or other electrical equipment. Jawer (2006) also found that those who were categorized as environmentally sensitive were significantly more likely to assert that they were affected by and effect electrical appliances.

There is a great deal of controversy regarding whether hypersensitivity to EMFs is the cause of EHS symptoms (for a literature review see Levallois, 2002).

While the evidence is far from clear-cut there is research suggesting that EHS and Electrosensitivity have a neurobiological basis (Sandstrom, Lyskov, Burgund et al., 1997; Lyskov, Sandstrom, & Mild, 2001; Levallois, 2002; Starlanyl, 2004; Landgrebe, Hauser, Languth et al., 2007). Langrebe et al. (2007) found evidence that those participants who reported being sensitive to EMFs differed from the general population in terms of cortical excitability parameters and altered central nervous system function. According to Langrebe et al. (2007) self reported electrosensitives displayed significantly reduced intracortical facilitation, which could possibly account for the higher vulnerability of these participants to environmental stimuli. Langrebe et al. (2007) state that the data “may indicate a neurobiological predisposition to higher vulnerability for environmental influences.” (p. 286) The results of a study by Leitgeb & Schrottner (2003) suggest that “very electrosensible people do exist and that they both individually and as a group can be differentiated from the general population.” (p. 393). Leitgeb & Schrottner (2003) also provide evidence that suggests that females are significantly more sensitive to electricity than men.

While there is research suggesting a neurobiological difference between reported electrosensitives and controls, the effects on humans of EMFs commonly found in the environment is another focus of research. Research involving transcranial magnetic stimulation (TMS) in the laboratory has been able to show consistent findings regarding the effects of high frequency, high intensity EMFs on humans (Marino, Nilsen, Chesson et al., 2004). TMS is a non-invasive method of exciting neurons in the brain through direct application of magnetic fields over desired areas of the brain. TMS has several uses in neuropsychology and according to Walsh and Rushworth (1999) “it is an essential weapon in the neuropsychologist’s contemporary armoury.”(p125) Walsh and Rushworth believe that TMS has proven that it can be used “to establish the necessity of a brain region for cognitive processes.”(p. 126) On the other hand research involving MF effects on humans in the real world environment has been inconsistent (Marino et al., 2004); however there is evidence that low-frequency, low-intensity electric and magnetic fields that are common in the environment are associated with various metabolic, behavioural and pathological effects (Barnes & Greenebaum, 2006 as cited in Carrubba et al., 2007b). When it comes to the effects of environmental MFs the central question to ask according to Marino et al. (2004) is whether magnetic fields, which are smaller in magnitude than those applied during TMS, are actually detected by human subjects. While there are

several possible explanations for the inconsistencies regarding MF detection in the environment Carrubba, Frilot, Chesson et al (2008) believe that the most common and global explanation is the “use of inapplicable methods of analysis.” (p. 104). Carrubba et al. (2008) goes on to point out that all previous studies of EMF-induced effects on brain activity used linear methods and were unable to reliably detect non-linear stimulus response patterns. The most recent research regarding the effects of MFs has been conducted utilizing non-linear methods and has provided evidence suggesting that both humans and animals can detect low strength MFs (Marino, Nilsen, Frilot, 2002; ; Marino et al., 2004; Carrubba, Frilot, Chesson et al., 2007a; Carrubba, Frilot, Chesson et al., 2007b; Carrubba et al., 2008). These results provide evidence that MFs commonly found in the environment have the capacity to alter electroencephalographic activity. Electroencephalographic activity is measured using an Electroencephalography (EEG) which measure electrical activity produced in the brain. The results of the studies are highly generalizable as the field strength and frequency utilized in these studies represent the field strengths and frequency commonly found in both general and workplace environments. The response rate for these experiments was a 100% in all but one study which means that there was an effect of the MF in almost all of the subjects (Carrubba et al., 2007a; Carrubba et al., 2007b; Carrubba et al., 2008; Marino et al., 2004). Carrubba et al (2007a) used an intra-subject design where each subject underwent three blocks (sham-field, sound, magnetic field) of 80 trials and where they were blind to when or for how long a field would be applied. Exposure took place in a darkened isolation chamber in order to reduce exposure to ambient stimuli. Equipment that controlled the coils and recorded the EEG were located outside the chamber in order to eliminate the possibility of audio or visual cues from the experimental apparatus (Carrubba et al., 2007a). The absence of sensory cues was further verified by interviewing the subject post experiment (Carrubba et al., 2007a). According to Marino et al. (2004) “the ability to detect low-strength, low-frequency MFs is a common property of the human nervous system.”(p. 1195). Carrubba et al. (2007a) provide evidence suggesting that the detection of weak magnetic fields is a form of sensory transduction, much like the other sensory stimuli. Block (1992) states that sensory transduction plays an indispensable role as it is the mechanism by which external physical cues are transformed into internal biochemical or electrical signals that can be put to further use. External cues carry an array of information about the environment and internal

cues present to the individual a distilled version of that information (Block, 1992). This process can be simple or complex and it varies among living organisms. Block (1992) points out that sensory modalities encompass more than the classic five senses as living things not only sense sound, light, chemicals, and pressure, but also position, heat, gravity, and electric and magnetic fields. There is a great deal of evidence that suggests birds, bees, butterflies, salmon, tuna, and a host of other organisms are able to detect low intensity magnetic fields directly; however the basis of their detection remains a mystery (Block, 1992). Carrubba et al. (2007a) believe that their evidence indicating that detection of weak MFs is a form of sensory transduction points to the idea that humans possess a 'magnetic sense' and that this ability to sense MFs falls below the level of consciousness. As mentioned above the methods for non-linear analysis of MFs is recent therefore the research has not taken into account individual sensitivity thresholds. However if an individual's 'magnetic sense' is similar to the other senses then there is good reason to believe that its sensitivity will vary among individuals and gender. Both environmental sensitivity and MFs have been linked with paranormal and apparitional experiences. The next section will review research regarding those links.

Jawer's (2006) research has found that certain characteristics are common among those with environmental sensitivities and environmental conditions and significantly different than controls. One of the differences pertains to paranormal experiences as those who were categorized as environmentally sensitive reported experiencing a higher number of paranormal and apparitional experiences (Jawer, 2005; 2006). Electrosensitivity, EHS, and fibromyalgia have also been linked with increased number of paranormal experiences in other studies (Shallis, 1983; Starlanyl, 2004). Shallis (1983) surveyed electrical sensitives and found that 69% claimed to have had at least one psychic experience. Past research has suggested that MFs could be linked with anomalous experiences associated with reportedly haunted locations; however this area of research has been plagued by inconsistencies similar to those regarding detection of magnetic fields by humans. Persinger, Tiller, & Koren (2000) were able to induce paranormal or haunt-type phenomena by stimulating the temporal lobe with TMS in laboratory settings. This discovery provided evidence suggesting that exposure to certain levels of magnetic fields could induce haunt-type experiences (Persinger et al., 2000). Haunt-type experiences refer to commonly reported phenomena (i.e. change of temperature, overwhelming emotions, visual apparitions)

experienced in haunted locations (Lange, Houran, Harte et al, 1996; Persinger et al., 2000; Wiseman, Watt, Greening et al., 2002). According to Braithwaite (2004) the general claim is that locations associated with haunt-type experiences may be magnetically remarkable in some way. However the effects of MFs on reported haunt-type experiences have not been consistently replicated in natural settings as some studies have reported both an increase in ambient geomagnetic fields<sup>1</sup> (GMFs) (Nichols & Roll, 1999 as cited in Braithwaite, 2004) and EMFs at reportedly haunted locations (Roll, Maher, & Brown, 1996; Roll & Nichols, 2000 all cited in Braithwaite, 2004) whereas other studies regarding haunt-type experiences and allegedly haunted locations found no field abnormalities (Maher, 2000). Recent research also suggests that it is the variation or fluctuation of low-level MFs and unusual ambient levels that lead to haunt-type experiences (Braithwaite, 2004). Cook and Persinger (2001) believed that certain individuals with above average temporal lobe sensitivity or labile temporal lobes were more susceptible to EMFs therefore report more haunt-type experiences; however attempts to replicate this work have failed (Granqvist, Fredrickson, Unge et al., 2005). Granqvist et al.'s (2005) attempt at replicating Persinger's work provided evidence that sensed presence or mystical experiences are not the result of magnetic fields but rather suggestibility. Granqvist et al (2005) also point out that the Makarec and Persinger's (1990) Temporal Lobe Signs (TLS) scales, which are used to categorize individuals with labile temporal lobes, are known to correlate with suggestibility which casts doubt regarding research correlating TLS scores and temporal lobe sensitivity with haunt-type experiences. It would seem likely that Persinger's method for categorizing temporal lobe sensitivity was simply picking out individuals more prone to suggestibility, therefore more likely to report paranormal experiences. In a review of past research Braithwaite & Townsend (2008) believe that while MF abnormalities do not provide a casual relationship to anomalous experiences there is definitely an association.

Since different sensitivities to environmental factors are well-established, if there were affects from MFs not everyone would react the same. If Carrubba et al.'s (2008) 'magnetic sense' is present in all humans and magnetic fields are associated with inducing haunt-type experiences perhaps those with an increased sensitivity to

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<sup>1</sup> Geomagnetic fields (GMFs) or the Earth's magnetic field is the magnetic force that surrounds the Earth. According to Buffet (2000) the Earth's magnetic field is largely produced through the movement of molten iron in the Earth's core as well as planetary rotation.

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the environment would be more likely to report haunt-type experiences. Jawer (2006) provides evidence that environmentally sensitive individuals do report more past paranormal experiences stating “if anomalous influences exist in the external environment, certain individuals will register these more clearly versus others who see, hear, feel, and smell through a denser veil of internal imagery”(p. 108). However since Jawer (2006) relied solely on self reports his results could be an artefact or the result of reporting bias.

The purpose of this study is to examine the relationship between environmental sensitivity and paranormal experiences. While past research has suggested that environmentally sensitive individuals report more paranormal experiences (Shallis, 1998; Jawer, 2005, 2006) this has never been tested in an allegedly haunted location. Based on the research already discussed on environmental sensitivity (Jawer, 2005, 2006) a second aim is to examine whether these environmentally sensitive individuals can indeed pick up on subtle differences in MFs and whether these differences lead to an increase in reports of haunt-type experiences thus excluding reporting bias. This study will be testing the following hypotheses:

1. Environmentally sensitive individuals will report significantly more prior paranormal experiences than non-sensitives.
2. Environmentally sensitive individuals will report significantly more haunt-type experiences at an allegedly ‘haunted’ location (Mary King’s Close) than non-sensitives.
3. Environmentally sensitive individuals will report significantly more haunt-type experiences in ‘High EMF’ rooms than ‘Low EMF’ rooms and there will be no significant difference between reported haunt-type experiences in ‘Low EMF’ rooms and ‘High EMF’ rooms for non-sensitives.

## **Methods**

### *Participants*

Participants were self selecting members of the public visiting Mary King's Close (MKC). Participants either responded to a flyer advertising events at MKC and other similar attractions or were informed of the study while making reservations to participate in the regular tours of MKC. The experiment was described in flyers as an opportunity to experience the regular history tours of MKC whilst taking part in a scientific experiment looking at whether environmental sensitivity may play a role in ghostly experiences. Participation was voluntary and participants' responses were anonymous. The study received ethical approval from the University of Edinburgh Psychology Department's ethics committee. There were a total of 25 groups tested. The number of participants in a group ranged from 5-17 individuals. Experimenters (who gave pre-tour instructions and answered questions) were the author (BM) and Dr. Caroline Watt (CW). Assistant experimenters accompanied groups on the tour and were blind to room EMF classification. Tour guides were members of MKC staff who led participants on the tours and requested participants to give checklist responses to each room prior to giving their spiel about each room's history. The tour guides were also blind to EMF classification.

### *Location*

The experiment took place at MKC (Edinburgh, Scotland) from May 12 through May 16, 2008. MKC is a reportedly 'haunted' tourist attraction that offers a 50 minute guided history tour of the close. Participants listened to an initial talk by CW or BM about the study and completed the Study Questionnaire in the waiting room of MKC prior to beginning the tour. After turning in the Study Questionnaire participants entered MKC with their tour guide and group and began the tour. The tour involved participants visiting 13 rooms, in 10 of which they were asked to report any unusual experiences. Three rooms were not used due to time constraints. While on the tour participants completed the Experiences Checklist.

### *Materials*

*Study Questionnaire:* The questionnaire consisted of 30 questions and is a modified version of Jawer's (2006) Environmental Sensitivity: A Survey Investigation

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of Human Factors questionnaire which originally consisted of 54 questions. Information gathered from this questionnaire involved the participants' demographics, past paranormal experiences, level of paranormal belief, environmental conditions and sensitivities, birth order, and level of imagination and introvertedness. (See Appendix A) The Study Questionnaire was also used to categorize participants as either 'environmentally sensitive' or 'non-sensitive' and to determine if participants had any prior knowledge of reported unusual phenomena at MKC. Participants were categorized based on their responses to selected questions (12 & 18). A participant was categorized as environmentally sensitive based on the combined score of questions 12 and 18. Each check counted as 1 point and if a participant had 3 or more points they were categorized as environmentally sensitive. Participants were also given an information sheet separate from the Study Questionnaire, which reviewed the procedures of the experiment, confidentiality, and right to withdrawal. The sheet also allotted space for individuals who wanted to know the study results to leave contact details.

*Experiences Checklist:* This checklist contained ten sections corresponding to ten rooms which the participants would visit one at a time while on the tour (See Appendix A). For each room on the checklist the participant was asked: Did you experience any unusual phenomena? For which they would either check yes or no. If the participant did experience any unusual phenomena they were asked to check one of the descriptors that best described their experience. The descriptors, which are based on previous research regarding commonly reported haunt-type experiences that can be interpreted as paranormal (Lange, Houran, Harte et al, 1996; Persinger et al., 2000; Wiseman, Watt, Greening et al., 2002) included; visual apparition, sense of a presence, auditory phenomena, dizziness/headache, objects moving, overwhelming feelings/emotions, unexplainable weakness of body parts, muscle pain, overwhelming fatigue, skin irritation, tactile phenomena, unusual lights/energy, change in temperature, tingling/burning sensation, nausea, unexplained pressure, or other. Participants were given a small space to describe any experiences that fell into the 'other' category. Participants were also asked whether they thought their experience was due to a ghost. Responses to this question were coded on a 5 point likert scale from 1 (definitely no) to 5 (definitely yes).

*EMF Measurement and Classification:* Magnetic field readings were taken by BM of the ten rooms used in the analysis using a TriField Broadband Meter, which

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is manufactured by Alpha Labs Inc. The Trifield Broadband Meter was specifically designed to find areas with high EMFs in homes, offices, and neighbourhoods. The meter face is analog (needle type) and has settings which enable it to measure electric fields, magnetic fields, and radio/microwave frequencies. Depending on where the knob is set, the meter detects frequency-weighted magnetic fields (two separate scales) or frequency-weighted electric fields in the extremely low frequency range. For the purposes of this study all readings involved magnetic fields. The standard measurement of MFs for this study will be milligauss. The meter has two magnetic field settings and sensitivities (0.5-100 milligauss at 50 Hz, and 0.2-3 milligauss at 50 Hz, the second sensitivity is to measure weak fields more accurately) The magnetic section consists of three ferrite-coils pointing in the X,Y, and Z directions (3-axis) and located in the geometric centre of the meter. Non-Linear circuitry combines the signals of these three into a true magnitude of the field strength, independent of which direction the meter is pointed. A frequency weighted meter was chosen in order to obtain a reading that is proportionally weighted to reflect the way in which the field is experienced by the human body. The magnetic field settings are frequency weighted from 30 to 500Hz and are calibrated at 50Hz (UK standard). For example, a 50Hz magnetic field with a strength of 2 milligauss will read '2' on the meter, but 100Hz at 2 milligauss will read '4' on the meter. This is to gauge the currents induced inside the body, which are proportional to field strength multiplied by frequency. AC current induced by the magnetic field (as opposed to the magnetic field itself) is most likely the cause of biological effects.

Baseline readings were taken in each of the ten rooms one month prior to beginning the experiment and each day of the experiment to ensure that the readings remained consistent with baseline throughout the experiment. Prior to taking the readings the meter was tested to ensure the battery was functioning properly and calibrated against high magnetic field sources. Readings were taken by BM in accordance with the instructions by the manufacturer regarding position of the hand while holding the meter. A total of 8 readings were taken in each room. Information regarding where participants would be standing during the tour was gathered and either a square or rectangle parameter was developed. Readings were taken in the corners (4), the centre (2), and the sides (2) of the each room's measurement area. The mean of those 8 readings was used as the final reading of that particular room. The purpose of the meter was to simply categorize the ten rooms into two categories; those

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with relatively low magnetic field readings and those with relatively high magnetic field readings. Based on the baseline readings the cut-off criteria to determine difference between 'Low EMF' and 'High EMF' rooms was over 1 milliguass. Therefore the difference between mean readings in 'Low EMF' and 'High EMF' rooms must exceed 1 milliguass. Using this categorization method 4 rooms were classified as 'Low EMF' and 4 were classified as 'High EMF'. Two rooms failed to exceed the difference of 1 milliguass therefore were considered borderline and removed from any analysis involving EMFs. (see Appendix B for mean readings of the 10 rooms) Independent EMF readings were also taken by an individual blind to prior readings of the MKC to ensure no subjective bias as well as to validate reliability of BM's readings. The results of the independent measurement produced similar readings resulting in all rooms being assigned to the same categories as mentioned above for BM's readings.

### *Procedure*

Prior to beginning the guided tour of MKC participants listened to an initial talk and completed the Study Questionnaire. BM or CW briefly explained the study's purpose and methodology as well as reiterated the participant's right to withdraw from the experiment at any time. CW and BM did not indicate the direction of the study's hypothesis. BM or CW also reviewed the Experiences Checklist and fielded any questions regarding the questionnaire or checklist. After participants completed the questionnaire they handed it in and were led down into MKC by their tour guide and their tour began. While on the tour the tour guide was responsible for pointing out the number of the room the participants were in as well as allowing a few moments upon entering a new room for the participants to quietly stand in the room and report any unusual phenomena. Participants were told to check any experiences or descriptors during this time so they would not be influenced by the tour guide's subsequent stories about the room or its history. Research assistants who were blind to the room's EMF classification were present in every tour group to ensure proper execution of protocol and to aid participants with any questions or confusion regarding the rooms. On return to the waiting room, checklists were handed in.

## **Results**

A total of 265 participants attended one of the 25 sessions. Of these, 14 were excluded as they did not complete all the items on the Study Questionnaire. Therefore, 251 participants remained 161 female (64.1%) and 90 male (35.9%). The mean age was 36.4 years (SD=13.39) with an age range of 15-76 years. In regards to educational level attained 29.1% reported a college degree, 25.1% reported obtaining a post graduate degree, 17.1% reported attending some college, 10.4% reported being a high school graduate, 8.4% reported some post graduate work, and 8% reported attending none or some high school.

In total there were 601 haunt-type experiences reported while visiting the 10 designated rooms inside Mary King's Close. The most reported experience involved an unusual change in temperature (28.8%), which was followed by Dizziness/Headache (16.3%), Sense of a Presence (9%), Nausea (7.3%), Tingling/Burning Sensation (6.8%), Unexplained Pressure (5%), Overwhelming Feeling or Emotions (4%), Auditory Phenomena (2.7%), Unexplainable weakness in parts of the body (2.5%), Skin Irritation (2%), Muscle Pain (1.8%), Overwhelming Fatigue (1.5%), Tactile Phenomena (1.3%). Visual Apparitions (1.2%) and the least reported phenomena Unusual Lights or Energy (.4%). Participants also reported other phenomena that were not provided on the checklist (9%).

### *Participant Classification*

Each participant was classified as either 'environmentally sensitive' or 'non sensitive' based on the procedure described in the methods section. Of the 251 participants 67 were categorized as environmentally sensitive (26.7%) and 184 were categorized as non-sensitive (73.3%). Of the 67 sensitive participants 49 (73.1%) were female and 18 (26.9%) were male. The non-sensitive group consisted of 184 individuals with 112 (60.9%) females and 72 (39.1%) males.

Those who were categorized as environmentally sensitive were also more likely to be female  $X^2(1) = 3.212, p < .05$ ; to report that their presence affects electrical or mechanical devices  $X^2(1) = 6.033, p < .05$ ; and to be more imaginative  $X^2(2) = 7.350, p < .05$  than non-sensitives. Data used for analysis regarding level of imagination (question 8, see appendix A) was collapsed due to having a cell with an expected count less than 5. The results of a Fisher's Exact Test showed a marginally

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significant interaction between environmental sensitivity categorization and reports of being struck by lightning or suffering an electrical shock ( $p=.0525$ , one-tailed).

There were no significant associations between environmental sensitivity and having an imaginary friend as a child  $X^2=1.550$ ,  $p>.05$ , or environmental sensitivity and being the first born or only child  $X^2=1.574$ ,  $p>.05$ .

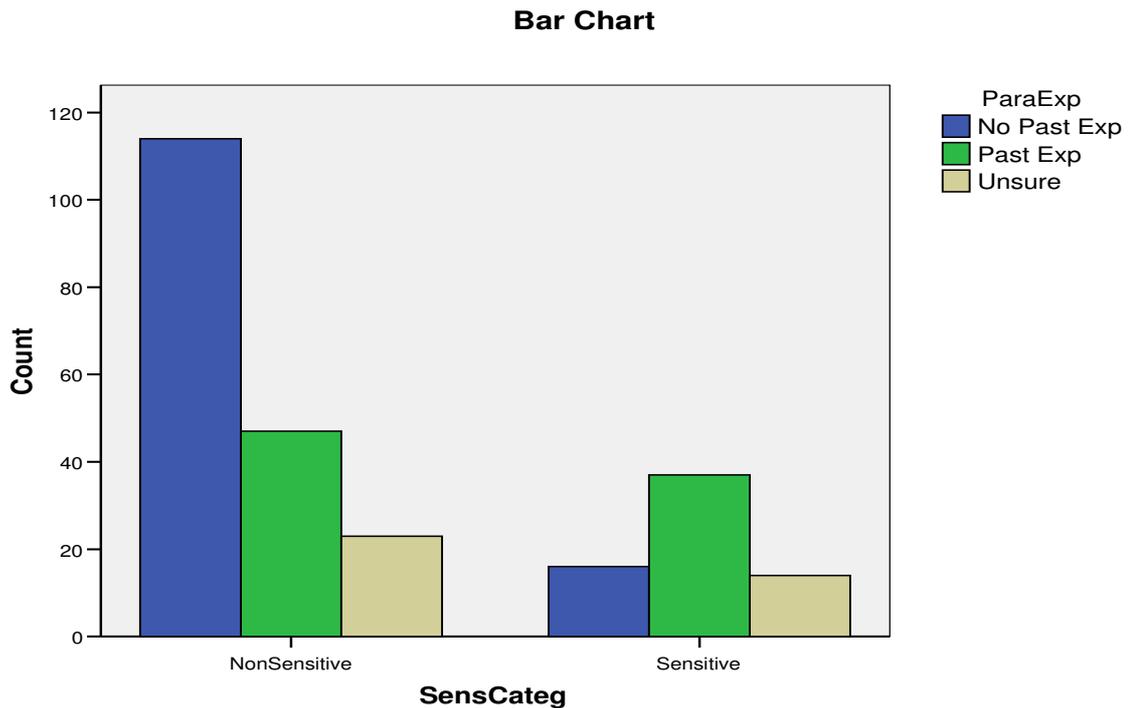
The results of a Mann Whitney test also revealed that those categorized as environmentally sensitive scored significantly higher on the paranormal beliefs scale than non-sensitives,  $U=3978.5$ ,  $p<.001$ .

### *Gender Differences*

A Mann Whitney test revealed that females scored significantly higher on the paranormal beliefs scale than males,  $U=5491.500$ ,  $p<.001$ .

### ***Hypotheses One: Environmentally sensitive individuals will report significantly more prior paranormal experiences than non-sensitives.***

Of the environmentally sensitive respondents 55% reported a prior paranormal experience, 24% reported no prior paranormal experience and 21% were unsure. Of the non-sensitives 26% reported a prior paranormal experience, 62% reported no prior paranormal experience and 13% were unsure (see Figure 1). Results of a 2x3 Chi-square show a significant association between environmental sensitivity and prior paranormal experiences  $X^2(2) = 29.025$ ,  $p<.001$ . These findings support hypothesis one. A Chi-square test also revealed no significant association between sex and prior paranormal experiences  $X^2=1.530$ ,  $p>.05$ .

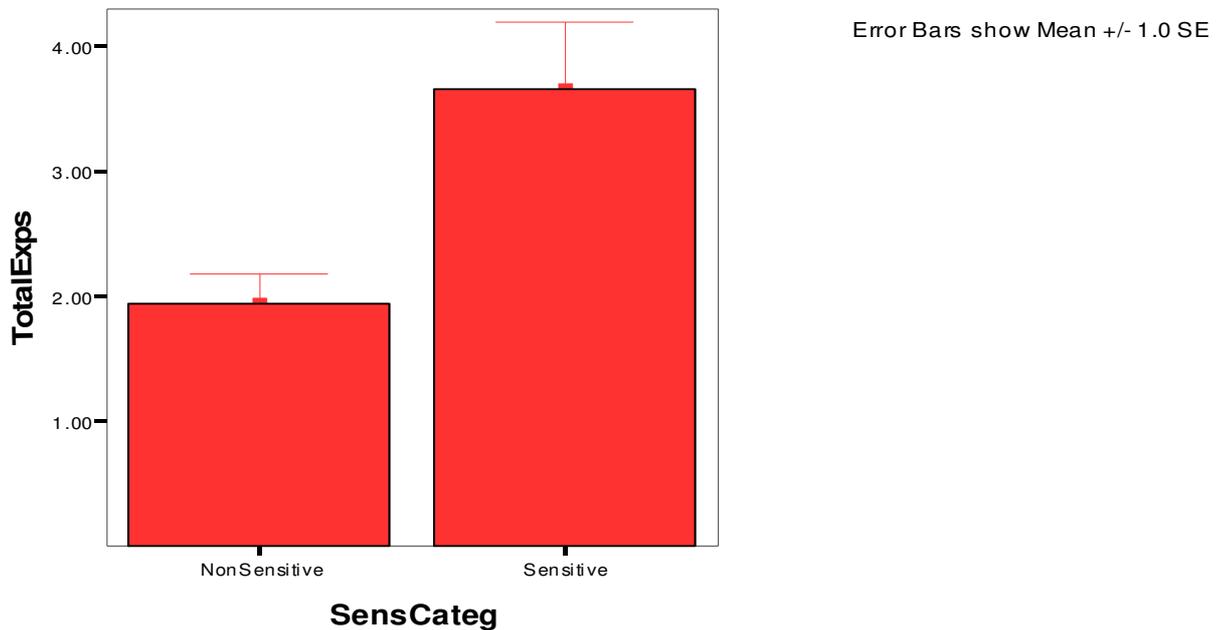


**Figure 1.** Observed counts of environmentally sensitive and non-sensitive participants regarding prior paranormal experiences

***Hypothesis Two: Environmentally sensitive individuals will report significantly more haunt-type experiences while touring an allegedly ‘haunted’ location (MKC) than non-sensitives.***

As mentioned above there were a total of 601 haunt-type experiences reported in Mary King’s Close. The mean number of haunt-type experiences while in MKC for environmentally sensitive participants was 3.656 whereas for the non-sensitives it was 1.934. On the average, those categorized as environmentally sensitive reported almost twice as many haunt-type experiences than non-sensitives (see Figure 2). The results of an independent t-test showed that sensitives ( $M=3.656$ ) reported significantly more haunt-type experiences than non-sensitives ( $M= 1.934$ ),  $t(249) = -2.894$ ,  $p<.01$ . These findings give support to hypothesis two. An independent t-test was also run to determine if there were any gender differences regarding haunt-type experiences in MKC. The results show that females ( $M=2.975$ ) reported significantly more haunt-type experiences than males ( $M=1.355$ ),  $t(249) = 3.336$ ,  $p<.001$ .

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**Figure 2.** Boxplot showing the total mean number of haunt-type experiences reported by environmentally sensitive and non-sensitive participants in Mary King's Close.

A second aim of the study was to examine whether people's haunt-type experiences may in part be due to subtle changes in the environment, specifically magnetic fields. Baseline magnetic field readings of MKC were taken one month prior to the experiment as well as everyday prior to the beginning of the tours to ensure that the readings remained consistent. Of the numerous rooms inside MKC participants were asked to report any experiences in 10 rooms. It was these 10 rooms where MF readings were taken. Of the 10 rooms we categorized the 4 rooms with the highest MF readings as the 'High EMF' rooms and the 4 with the lowest readings as the 'Low EMF' rooms. The remaining two rooms were borderline therefore they were removed from the analysis as described in methods section. Throughout the experiment there were a total of 40 readings taken in the eight rooms used in the MF analysis ( $M=2.00$  milliguass). The mean readings of the 'High EMF' rooms (2.928 milliguass) were nearly three times as high as the mean readings in the 'Low EMF' rooms (1.072 milliguass). An independent t-test was run to determine if these differences were significant. The results showed that 'High EMF' rooms ( $M= 2.928$  milliguass) were

significantly different than ‘Low EMF’ rooms ( $M=1.072$  milliguass),  $t(6) = -7.300$ ,  $p<.001$ .

***Hypothesis 3: Environmentally sensitive individuals will report more haunt-type experiences in ‘High EMF’ rooms than ‘Low EMF’ rooms and there will be no significant difference between reported haunt-type experiences in ‘Low EMF’ rooms and ‘High EMF’ rooms for non-sensitives.***

There were a total of 203 reports of one or more haunt-type experiences in ‘High EMF’ rooms and 152 in ‘Low EMF’ rooms. The mean number of haunt-type experiences in ‘High EMF’ rooms was .81 whereas in ‘Low EMF’ rooms the mean was .60 (see Table 1). A Wilcoxon test was run with the overall data set (sensitives +non-sensitives) and the number of haunt-type experiences reported was significantly more in ‘High EMF’ rooms than ‘Low EMF’ rooms,  $T= 1787.50$ ,  $N=251$ ,  $p<.001$ .

Environmentally sensitive participants had a total of 83 reports of one or more haunt-type experiences in ‘High EMF’ rooms ( $M= 1.23$ ) and 58 in ‘Low EMF’ rooms ( $M= .86$ ) (see Table 1). The results of a Wilcoxon test showed that those categorized as environmentally sensitive reported significantly more haunt-type experiences in ‘High EMF’ rooms than ‘Low EMF’ rooms,  $T= 21.00$ ,  $N=67$ ,  $p<.01$ .

Non-sensitives had a total of 127 reports of one or more haunt-type experiences in ‘High EMF’ rooms ( $M= .65$ ) and 85 in ‘Low EMF’ rooms ( $M= .51$ ) (see Table 1). The results of a Wilcoxon test suggest that much like sensitives the non-sensitives also reported significantly more haunt-type experiences in ‘High EMF’ rooms than ‘Low EMF’ rooms,  $T= 25.00$ ,  $N=184$ ,  $p<.05$ .

**Table 1.**

*Mean number of reported haunt-type experiences and standard deviations (in parentheses) for environmentally sensitive and non-sensitive participants in ‘High EMF’ rooms and ‘Low EMF’ rooms as well as the total mean number of reported haunt-type experiences for combined data.*

	Room Category	
	High EMF	Low EMF
Sensitive*	1.23 (1.20)	.86 (1.19)
Non-Sensitive*	.65 (1.08)	.51 (.86)
Total*	.80 (1.14)	.60 (.97)

Note. \* denotes significant difference between rooms

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In order to ensure that experiences reported were genuine and not the result of prior knowledge or bias all individuals who had reported prior knowledge of MKC were removed. Therefore participants who reported being on a previous tour of MKC or reported prior knowledge of areas inside MKC that have had reports of unusual phenomena were removed (76 participants) and the Wilcoxon tests were run again.

In the overall data set the number of reported haunt-type experiences remained significantly higher in 'High EMF' rooms than 'Low EMF' rooms,  $T=684$ ,  $N=175$   $p<.01$ . However, further analysis showed that environmentally sensitive participants continued to report significantly more haunt-type experiences in 'High EMF' rooms than 'Low EMF' rooms,  $T=88$ ,  $N=47$   $p<.01$ ; whereas there was no significant difference between number of haunt-type experiences reported in 'High EMF' rooms and 'Low EMF' rooms for the non-sensitives,  $T=279$ ,  $N=128$ ,  $p>.05$  (see Table 2). After removal of participants with prior knowledge of MKC the findings give support to hypothesis three.

**Table 2.**

*Mean number of reported haunt-type experiences and standard deviations (in parentheses) after removal of participants with previous knowledge of MKC for environmentally sensitive and non-sensitive participants in 'High EMF' rooms and 'Low EMF' rooms as well as the total mean number of reported haunt-type experiences for combined data.*

	Room Category	
	High EMF	Low EMF
Sensitive*	1.29 (1.19)	.87 (1.19)
Non-Sensitive	.51 (.96)	.44 (.81)
Total*	.72 (1.08)	.56 (.94)

Note. \* denotes significant difference between rooms

Researchers attempted to determine if other environmental factors or cues could be leading to significantly more reports of haunt-type experiences in 'High EMF' rooms. Members of MKC staff were asked to place the 10 rooms used in the study in order from least haunted or eerie (10) to most haunted or eerie (1). The results of the haunted order as well as corresponding room numbers and number of haunt-type experiences are represented in Table 3. Results of a Spearman's

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correlation coefficient test showed that there was not a significant relationship between the haunted order and the number of haunt-type experiences reported,  $r_s = -.30$ ,  $N=10$ ,  $p > .05$  (two-tailed). Researchers also had members of MKC staff rank the 10 rooms in regards to perceived EMF levels. MKC staff was asked to rank the rooms from those that they believed had the lowest magnetic fields or fewest electronics (10) to those that they believed had the highest magnetic fields or most electronics (1). Table 4 shows the results of the EMF ranked order as well as corresponding rooms and actual MF readings. Spearman's correlation coefficient test showed that there was not a relationship between perceived EMF ranks of the rooms with actual MF levels,  $r_s = .31$ ,  $N=10$ ,  $p > .05$  (two-tailed). These results suggest that environmental cues such as perceived eeriness of the rooms or perceived level of EMF did not impact reports of haunt-type experiences.

### Table 3.

*Room number and corresponding haunted order rank and number of haunt-type experiences reported.*

Room #	Haunted Order	# of Experiences
18(H)	1 <sup>st</sup>	32
9(H)	2 <sup>nd</sup>	64
13(B)	3 <sup>rd</sup>	70
6(L)	4 <sup>th</sup>	43
3(L)	5 <sup>th</sup>	43
8(H)	6 <sup>th</sup>	51
19(L)	7 <sup>th</sup>	35
2(B)	8 <sup>th</sup>	29
15(H)	9 <sup>th</sup>	57
4(L)	10 <sup>th</sup>	42

Note. Room numbers correspond to visible numbers already displayed in MKC.<sup>2</sup>

B=borderline room, L= low emf room, H= high emf room.

Haunted order, 1= most haunted/ eerie, 10= least haunted/eerie

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<sup>2</sup> Every room in MKC has a number visibly displayed. These numbers are in place to correspond to audio guides that are given to visitors who have hearing issues or are visiting from other countries. In order to eliminate confusion pre-existing room numbers were used on experiences checklist and these numbers correspond to visible numbers already displayed in MKC. This helped as guides could simply point to the room number that the participants were in. While the rooms were not in exact chronological order participants did visit room 2 first followed by 3, 4, 6 and so on until 19.

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**Table 4.**

*Room number and corresponding perceived EMF order ranks as well as actual MF readings*

Room #	Perceived EMF Rank	Mean MF Readings (Milliguass)
6(L)	1 <sup>st</sup>	0.582
9(H)	2 <sup>nd</sup>	2.376
4(L)	3 <sup>rd</sup>	1.288
15(H)	4 <sup>th</sup>	3.274
3(L)	5 <sup>th</sup>	1.195
2(B)	6 <sup>th</sup>	1.494
19(L)	7 <sup>th</sup>	1.224
8(H)	8 <sup>th</sup>	3.081
18(H)	9 <sup>th</sup>	2.982
13(B)	10 <sup>th</sup>	1.434

Note. Room numbers correspond to visible numbers already displayed in MKC.

L= low emf room, H= high emf room.

EMF order, 1= highest perceived MF, 10= least perceived MF

## **Discussion**

The current study examined the relationship between environmental sensitivity and paranormal experiences. The results of the present study confirmed that those categorized as environmentally sensitive were more likely to report past paranormal experiences than non-sensitives. Environmentally sensitive individuals also reported significantly more haunt-type experiences in a natural setting while touring an allegedly haunted location (MKC) than non-sensitives.

The study was also interested in whether environmentally sensitive individuals responded to subtle changes in MFs resulting in significantly more reports of haunt-type experiences. The results support the contention that there were differences between the numbers of haunt-type experiences reported in 'High EMF' rooms than 'Low EMF' rooms. Further analysis showed that when participants with prior knowledge of MKC were removed environmentally sensitive participants reported significantly more haunt-type experiences in 'High EMF' rooms than 'Low EMF' rooms whereas there was no significant difference in reports of haunt-type experiences between 'High EMF' and 'Low EMF' rooms among non-sensitives. This supports the hypothesis that environmentally sensitive individuals are more likely than non-sensitives to report haunt-type experiences when subtle magnetic differences are present. It also provides strong evidence that the reports of haunt-type experiences were genuine and not the result of prior knowledge.

*Why do environmental sensitives reports more paranormal and haunt-type experiences?*

Our findings that environmentally sensitive participants were more likely to report past paranormal experiences are consistent with previous research findings (Jawer, 2005, 2006). The results of our study also showed that environmentally sensitive participants reported significantly more haunt-type experiences in a natural setting than non-sensitives. There are several theories which could be possible for the differences between environmentally sensitive participants and non-sensitives regarding reports of past paranormal experiences and haunt-type experiences in MKC. Beginning with Jawer's (2006) view it could be that environmentally sensitive people are picking up on or noticing something that non-sensitives cannot. Jawer (2006) states that "persons having a certain degree or configuration of sensitivity could

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register (either consciously or unconsciously) anomalous influences in the environment that bypass most other people.”(p. 36). At this point it is unclear on what environmental cue or cues they are picking up on or interpreting as paranormal. Other possible explanations could be that those who are environmentally sensitive are also more likely to have a fantasy prone personality (i.e. individuals that immerse themselves in a rich and vivid fantasy life that blurs the lines between fantasy and reality) or have previous paranormal beliefs both of which past research has shown would make them more likely to report paranormal experiences (Wilson & Barber, 1983; Lange et al., 1996).

Through interviews and tests Wilson and Barber (1983) found that fantasy prone individuals differed from controls in that they were more likely to have vivid sensory experiences and report psi and paranormal experiences. Thalbourne (2000) also found that transliminality is correlated with paranormal experiences, mystical beliefs, and hypersensitivity to environmental stimulation. Transliminality is defined as a hypersensitivity to psychological material (imagery, ideation, affect, and perception) originating in (a) the unconscious, and/or (b) the external environment (Thalbourne & Maltby, 2008). These studies suggest that fantasy proneness and high levels of transliminality lead individuals to view themselves as different, sensitive, or psychically gifted (Wilson & Barber, 1983; Thalbourne, 2000; Jawer, 2006). The results of our study found that while environmentally sensitive individuals were more likely to view themselves as thinking more imaginatively than non-sensitives, there was no association between sensitivity and having an imaginary friend as a child, which can be sign of a vivid fantasy life. Jawer (2006) also found that environmentally sensitive individuals rated themselves as higher in imagination than controls, however he believes that this is the result of environmentally sensitive individuals being more likely to equate their sensitivity with imagination ( i.e. penchant for perceiving the world differently). While there does seem to be a correlation between environmental sensitivity and imagination, whether fantasy proneness and transliminality correlate with environmental sensitivity should be questioned. Wilson and Barber (1983) and Thalbourne (1996) used different methods when gathering information about their participant’s heightened environmental sensitivity. Wilson and Barber (1983) used a structured interview and included a couple questions on sensory experiences which were based on Higard (1970). Higard’s (1970) questions regarding sensory experiences focused entirely on aesthetic

appreciation of nature. What Wilson and Barber (1983) found was that fantasy prone individuals reported being acutely aware of and focused on sensory experiences since childhood because they found sensory experiences to be enjoyable. While being acutely aware of and focused on sensory experiences is possibly a characteristic of fantasy prone individuals it is not equivalent to suffering from environmental conditions due to hypersensitivity to the environment, which was the basis for categorization in this study. Thalbourne's (1996) method for measuring hypersensitivity to environmental stimuli was based on a list of seven true or false items. Thalbourne (1996) uses the term hyperesthesia to describe those with who were hypersensitive to environmental stimulations. Hyperesthesia is defined as a state of abnormally increased sensitivity to stimuli. Thalbourne's (1996) items categorize environmental sensitivity as being the result of one or more experiences of environmental sensitivity to stimuli rather than an ongoing condition. For example one could experience hyperesthesia simply by drinking an excessive amount caffeine the effects of which would wear off in hours (Bolton & Null, 1981), however the experience would result in reporting true for many of the items of the Thalbourne's (1996) questionnaire. It is clear that environmental sensitivity as defined in this study had never been directly correlated with fantasy proneness or transliminality.

Past research has provided evidence that people's belief or disbelief in the paranormal can be correlated with paranormal experiences or reports (French, 1992). Research suggests that people who believe in ghosts report perceiving more ghostly phenomena (Lange et al., 1996; Lange & Houran, 1998; Wiseman et al, 2002). The current study also found that environmentally sensitive participants scored significantly higher on the paranormal beliefs scale than non-sensitives suggesting that this could be a possible reason for an increase in reports of paranormal phenomena for sensitives; however this does not explain the clustering of haunt-type experiences in 'High EMF' rooms.

### *Magnetic Field Differences*

The results of the current research also found that overall there were significantly more reports of haunt-type experiences in 'High EMF' rooms than 'Low EMF' rooms. The 'High EMF' rooms were the rooms with relatively higher MF readings than the 'Low EMF' rooms. A possible explanation was that participants were responding to some environmental stimuli or signal other than MFs that led to

the clustering of experiences in 'High EMF' rooms. According to Wiseman et al (2002) individuals can associate certain visual features of a room (e.g., corners, staircases, or doorways that conform to popular conceptions of haunted locations) with the presence of a ghost, and these expectations then became self-fulfilling prophecies by producing psychosomatic phenomena when individuals visit these areas. In order to rule this out researchers had MKC staff rank the 10 rooms in order from most haunted or eerie to least haunted or eerie. What we found was that there was no correlation between the number of reported haunt-type experiences and haunted order. Therefore the rooms that were regarded as the most haunted or eerie were not the ones that a majority of haunt-type experiences were reported.

Researchers also thought that participants knowing that EMF levels were taken of the MKC could have been reporting experiences in rooms they believed had the highest MFs. In order to rule this out researchers had MKC staff rank the 10 rooms in order from those they perceived as having the highest EMF or electronics to those they believed had the lowest EMF or fewest electronics. We found that there was no correlation between perceived EMF level and actual EMF levels. This suggests that participants most likely could not perceive which rooms had the highest EMF levels and respond in accordance. By discovering no pattern regarding perceived eeriness and perceived EMF levels this gives more evidence to past research regarding haunt-type experiences being related to the increase in MF levels (Roll & Nichols, 2000 as cited in Braithwaite, 2004).

According to Carrubba et al. (2008) there is evidence to suggest that all humans possess a magnetic sense, which has the ability to detect low strength, low frequency MFs below the level of consciousness. While the mechanisms and anatomical location of a magnetic sense remain unclear, our results do provide support to past research which suggests that MF differences are associated with reports of haunt-type experiences (Braithwaite, 2004; Braithwaite & Townsend, 2008). The idea that humans possess a magnetic sense would fit in line with a great deal of research that provides evidence that some species of bacteria, bees, snails, birds, and fishes have the capacity to detect magnetic fields as it aids in navigation, finding food, and avoiding predators (Manger et al., 1995, 1995 as cited in Carrubba et al, 2008; Walker, Diebel, Haugh et al., 1997; Nemeč, Altmann, Marhold et al., 2001). Carrubba et al. (2008) believe that perhaps vestiges of these detection systems still exist in humans. Whether it was participants' ability to detect subtle changes in

'High EMF' rooms that led to an increase in haunt-type experiences remains unclear, however it is possible that the effects of MFs led to ambiguous stimuli which the participants interpreted as paranormal.

Lange and Houran (1998) provide evidence that haunt-type experiences are simply the result of individual's interpretation of ambiguous stimuli. Lange and Houran (1998) suggest that ambiguous stimuli with no conventional explanation leads to fear, which when mixed with intolerance for ambiguity leads to the formulation of paranormal beliefs. These paranormal beliefs then provide a framework for interpretation of the fear-inducing stimuli resulting in an increase in labelling the experience as paranormal (Lange & Houran, 1998). By labelling the ambiguous stimuli as paranormal it decreases the fear associated with the ambiguous stimuli by providing some sort of explanation. The ambiguous stimuli involved in the current study could be the effects of the MFs, which are interpreted as haunt-type experiences. Common symptoms experienced in EHS include; a burning or tingling sensation, confusion, poor concentration, fatigue/weakness, body pains, dizziness, headaches, nausea, and ear ringing (Grant, 1997; Hillert, Hedman, Soderman, & Arnetz, 1999;). These EHS symptoms overlaps considerably with common types of haunt-type experiences reported in prior research (Lange et al., 1996; Persinger et al, 2000; Persinger, Koren, & O'Connor, 2001) as well as the current study. For example a participant in the current study reported a tingling or burning sensation in one of the 'High EMF' rooms for which they checked that they had a haunt-type experience. Taking into account the above research it is possible that the participant was presented with an ambiguous stimulus caused by MFs (i.e. tingling) for which they could not find a conventional explanation. This situation coupled with past paranormal beliefs could have led to interpreting the stimuli as paranormal.

Until now we have only discussed the effects of MFs in all participants due to their being significantly more reported haunt-type experiences in total in 'High EMF' than 'Low EMF' rooms. Another interesting finding of the present study was that participants who are environmentally sensitive reported significantly more haunt-type experiences in 'High EMF' rooms than 'Low EMF' rooms, whereas there was no significant difference regarding number of reported haunt-type experiences between Low and High EMF rooms among non-sensitives. These findings suggest that environmentally sensitive participants were picking up on or able to detect environmental changes or occurrences that non-sensitives did not which supports past

research (Jawer, 2006). If these changes or occurrences were the result of MFs it would seem that non-sensitives and sensitives do differ in their magnetic sense. Environmentally sensitive individuals could have magnetic field threshold sensitivity much lower than the general population similar to their lowered threshold among other environmental stimuli. Shallis (1983) suggests that we all have some threshold-level of tolerance to the hazards in the environment (germs, allergens, stress) and will remain free of symptoms providing the level of stresses does not cross that threshold. Once the threshold is exceeded we display symptoms. Shallis (1983) believed that these thresholds varied among individuals and circumstances, which is way he suggests women report that environmental conditions worsen during menstruation and pregnancy as their threshold level is lowered due to additional bodily stress. It could be possible that environmentally sensitive individuals are more likely to have a lower MF threshold or more sensitive magnetic sense than non-sensitives which led to an increase in ambiguous stimuli and haunt-type experiences in 'High EMF' rooms.

Other possible reasons for the increases in reports of haunt-type experiences found regarding environmentally sensitive participants in 'High EMF' rooms could be the result of increased paranormal belief and environmental contaminants overlooked in the study. As discussed earlier environmentally sensitive participants scored significantly higher than non-sensitives on the paranormal belief scale. This suggests that environmentally sensitive participants are more susceptible than non-sensitive to paranormal beliefs. According to French et al. (in press) research regarding paranormal beliefs should "focus more directly upon the possible neuropsychological bases for susceptibility to paranormal belief and the reporting of ostensibly paranormal experiences"(p. 22) Based on the research discussed earlier regarding environmental sensitivity's possible neurobiological origins and genetic predispositions this sensitivity could pose as a neuropsychological bases for paranormal beliefs.(Jawer, 2006) Taking into account Lange and Houran's (1998) ambiguity theory it would seem likely that environmentally sensitive individuals would be subjected to more ambiguous stimuli earlier and more frequently than non-sensitives throughout their lives due to their hypersensitivity to the environment. In this case not knowing the cause of the ambiguous stimuli throughout their lives may have made them more likely to believe in the paranormal and thus report more paranormal experiences. Therefore an individual's biological and genetic predisposition (environmental sensitivity) leads to an increase in ambiguous stimuli,

which in turn leads to an increase in paranormal beliefs and reported haunt-type experiences. According to Hollingham (2004) most individuals underestimate the impact of sensory experiences in determining our individual preferences. Hollingham goes on to state that “everything we learn from birth is dependent on our sensory experiences”(p. 43) It is important to point out that belief in the paranormal is not a one-dimensional entity and it is likely that different biases would underline different types of belief (French, 1992). For example belief in extra sensory perception (ESP) could arise due to failure to appreciate the probability of coincidences or probabilistic reasoning whereas such biases are unlikely to be associated with ghosts (French, 1992). Therefore it would be likely that environmental sensitivity is a bias for an increase in the belief in ghosts and haunt-type phenomena, however unlikely to be linked to precognition or telepathy.

The clustering of reported haunt-type experiences in ‘High EMF’ rooms could be a result of other environmental factors besides MFs that environmentally sensitive participants interpreted as paranormal. Perhaps ‘High EMF’ rooms differed than ‘Low EMF’ rooms in air quality or mold, which led to an increase in reported haunt-type experiences. Mold is another name for fungi that is present in the indoor environment. Spores released by the fungi (mold) contain allergens, which can cause allergy exacerbation (Science Daily, 1999). Mold is a contaminant that has been attributed to sick building syndrome, which has symptoms (i.e. headaches, dizziness, nausea, fatigue, difficulty concentrating, overwhelming emotions) similar to commonly reported haunt-type phenomena (Science Daily, 1999).

According to Lange et al (1996) “a complete explanation of haunting experiences should take into account both electromagnetically induced neurochemical processes and factors related to contextual mediation.”(p. 755) Along similar lines Braithwaite and Townsend (2008) state that “searching for a single explanation for apparitional haunt-type experiences is a folly.”(p 91) Braithwaite and Townsend (2008) go on to state that “the more helpful view would be to fractionate this notion of a unitary explanation and begin a detailed assessment of the many potential factors underlying the haunt-type experience and how these factors may interact or impede each other in the natural setting.”(p. 91) The results of this study suggest that another piece of the puzzle regarding haunt-type experiences is an individual’s level of environmental sensitivity. The results of this study further suggest that MFs in combination with environmental sensitivity and contextual variables (i.e. past

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beliefs/expectations, suggestion that environment will be haunted) will lead to an increase in reports of haunt-type experiences.

### *Additional Points of Interest*

As discussed in the introduction females were more likely to be effected by environmental conditions such as migraines, fibromyalgia, allergies, and asthma. Therefore it would be expected that that females would be more likely to be categorized as environmentally sensitive which was found in the current study. Females were also significantly more likely to report haunt-type experiences in a natural setting however there was no difference among genders in regards to reports of past paranormal experiences. Females also scored significantly higher on the paranormal beliefs scale than males. This is consistent with past research indicating that females are more likely to report stronger paranormal beliefs and experiences than males (Rice, 2003; Aarnio & Lindeman, 2005). Possible explanations for gender differences regarding paranormal belief and experiences in women include increased levels of fear (Lange & Houran, 1998) and decreased levels of analytical thinking in women (Aarnio & Lindeman, 2005). Past research suggests that women in general experience more fear and apprehension than men (Al-Issa, 1980 as cited in Lange & Houran, 1998) as well as a greater fear of the paranormal (Lange & Houran, 1998). According to Aarnio and Lindeman (2005) women's higher intuitiveness and lower analytical thinking partially explain their higher amount of paranormal beliefs compared to men. Intuition can be defined as the ability to sense or know immediately without reasoning. It could be that sensitive females and females in general are reacting to and relying on what they sense or feel in the environment more than males. It could be that women who have been shown to have greater sensitivity across all five senses (Velle, 1987 as cited in Jawer, 2006) rely more heavily on their superior sensory abilities, whereas men rely more on analytical thinking rather their there senses.

When discussing paranormal and apparitional experiences it is important to keep an open mind. While there is no conclusive evidence that apparitions exist there is also no conclusive evidence that they do not. Research regarding psi phenomena is also a controversial topic however there is enough scientific evidence to warrant continued investigation (for a review see Irwin, 1999). According to Jawer (2007) what we marginalize as extra sensory perception may instead be an individual's

highly refined capacity to fix on a range of stimuli that never really registers with the general population. Shallis (1983) has a similar view and he presents case studies and personal experiments with severely allergic patients claiming that they display a remarkable gift for clairvoyance and extra-sensory perception. Shallis (1983) believes that sensitives' lowered thresholds somehow make them more open to another level of susceptibility in which they can reach out into other people's thoughts and feelings. Taking a less sceptical approach to the results of this study a possible explanation for environmentally sensitive participants reporting significantly more haunt-type experiences in MKC involves the imprint theory. The imprint theory is a popular theory among ghost hunters (Danelek, 2006). This theory suggests that ghostly manifestations and haunt-type phenomena are the reflection of a moment in time that has somehow been inscribed or imprinted in the environment (Danelek, 2006). For example at the moment of a violent death of an individual the intense emotions and electrical properties of that individual are released affecting and becoming imprinted in the electromagnetic fields of the local environment (Shallis, 1983) In essence the event becomes imprinted in the walls of the room like an emotional memory (Shallis, 1983). Taking the imprint theory into account it could be that environmentally sensitive participants due to their increased magnetic sense or lowered MF threshold level were more likely to pick up signals in the local magnetic field, which allowed them to feel and experience the environment's past, emotional atmosphere, and prior occupants (Shallis, 1983) therefore leading to more haunt-type experiences.

### *Limitations and Considerations for Future Research*

The questionnaire used for the classification of environmental sensitivity relied heavily on self-reports, which makes the questionnaire subjective, and leaves room for response distortion. Kline (1998) believes that self reports can lead to subjects lying, misinterpreting word meanings, social desirability, and acquiescence. Other possible issues with retrospective self reports involving the report of physical conditions involve insufficient recall, unsupported perceptions, or possible hypochondria (Jawer, 2006). Due to time constraints a more in-depth questionnaire was not practical. Further research is also needed to determine if there exist correlations between environmental sensitivity as defined in this study and fantasy-prone personality, transliminality, suggestibility, absorption, and low tolerance for ambiguity.

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There were also procedural limitations involved in the study. A major issue was that participants had to tour the venue in groups and were led through the tour by a guide. Even though efforts were taken to ensure that participants did not influence one another's responses to the Experiences checklist this could not be entirely ruled out. Due to legal and practical issues it would have been impossible to have individuals tour MKC independently without others or a guide, however future research would benefit by selecting a location where it is possible to exclude these factors.

This was the first study to our knowledge that investigated the relationship between environmental sensitivity and haunt-type experiences in a natural setting. This was also the first study to incorporate a High/Low EMF room categorization method therefore the results should be taken with caution as replicability and peer-review of the methodology are essential. Future research should continue to take into account frequency-weighted as well as non-frequency weighted EMF levels and GMF levels, which due to practical reasons could not be utilized in the current study. More in-depth and accurate EMF measurements are also needed to determine more precise MF complexity and ambient background levels. Future research should also obtain a more in-depth analysis of the environment in regards to air quality, excess mold, and other possible environmental contaminants. Limitations aside we believe that the results of the study provided enough evidence to warrant further research.

### *Conclusion*

The present study investigated the relationship between environmental sensitivity and paranormal experiences. The results suggest that environmentally sensitive individuals report significantly more past paranormal experiences than non-sensitives which is consistent with past research (Jawer, 2006). The results also provided evidence that environmentally sensitive participants report significantly more haunt-type experiences than non-sensitives in a natural setting (MKC). Similar to research discussed earlier the present study also found an association between MFs and an increase in reports of haunt-type experiences. In total there were significantly more reports of haunt-type experiences in 'High EMF' rooms than 'Low EMF' rooms. Environmentally sensitive individuals also reported significantly more haunt-type experiences in 'High EMF' rooms than 'Low EMF' rooms whereas there was no difference in reports of haunt-type experiences between rooms for non-sensitives.

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These results took into consideration environmental cues (perceived eeriness and EMF) and prior knowledge which provides more evidence that environmentally sensitive participants were responding to actual differences in MF levels.

Environmentally sensitive participants also scored significantly higher on the paranormal beliefs scale than non-sensitives. Taken as a whole the evidence from the current study suggests that increased MFs in combination with environmental sensitivity and contextual variables lead to an increase in reports of haunt-type experiences. It can also be said that the results suggest that environmentally sensitive individuals experience a different world than non-sensitives. Jawer (2005) believed that this sensitivity goes to the very heart of the dictionary definition: “capable of registering very slight differences or changes of condition.”(p. 108).

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## Appendix A: Materials

### Study Questionnaire:

<b>SENSITIVITY AND UNUSUAL EXPERIENCES</b>
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This survey gathers information about your paranormal beliefs, familiarity with Mary King's Close, and environmental sensitivity.

Please answer the questions honestly and to the best of your knowledge. All responses will be kept confidential. This survey is entirely anonymous and participants and data gathered from it are identified by number only.

Thank you for your time and participation in this study.

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1) Your age: \_\_\_\_ (years)

2) Gender: Male \_\_\_\_ Female \_\_\_\_

3) Have you been on a tour of Mary King's Close before?

Yes \_\_\_\_ No \_\_\_\_

4) Have you heard (e.g., from acquaintances, television programmes or newspaper articles) where in Mary King's Close people have reported experiencing unusual phenomena?

Yes \_\_\_\_ No \_\_\_\_ Uncertain \_\_\_\_

5) Are you currently (check one): Married \_\_\_\_ Divorced or separated \_\_\_\_

In long-term partnership \_\_\_\_ Single; never married \_\_\_\_ Widowed \_\_\_\_

6) Highest educational level attained (check one):

Some high school \_\_\_\_ College graduate \_\_\_\_  
 High school graduate \_\_\_\_ Post graduate work \_\_\_\_  
 Some college \_\_\_\_ Graduate degree(s) \_\_\_\_

7) Are you right-handed? \_\_\_\_ Left-handed? \_\_\_\_ or Ambidextrous? \_\_\_\_

8) How would you describe your tendency toward imagination? Please circle one of the numbers below:

Think Literally				Think Imaginatively
1	2	3	4	5

9) How would you describe your personality? Please circle one of the numbers below:

Introverted				Extroverted
1	2	3	4	5

10) Are you the first born or only child? \_\_\_\_

11) As a child, did you have an imaginary companion? Yes \_\_\_\_ No \_\_\_\_

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12) Have you ever been affected by any of the following? (check any that apply; if not, leave blank):

Asthma	_____	Depression/mood imbalance	_____
Allergies	_____	Chronic fatigue/exhaustion	_____
Migraine headaches	_____	Unusual sensitivity to electrical fields	_____
Sleep disorder	_____	Unusual sensitivity to chemicals	_____
Fibromyalgia/chronic pain	_____	Unusual sensitivity to light or sound	_____
Synesthesia (overlapping senses, such as seeing sounds or tasting shapes)	_____		

13) If you checked 'synaesthesia' above, please indicate what form of the condition you have.

\_\_\_\_\_

14) Have you ever been struck by lightning or suffered a severe electric shock?

Yes \_\_\_\_\_ No \_\_\_\_\_

15) Does your presence ever appear to affect electrical or mechanical devices (such as watches, computer monitors, home appliances, automobile ignitions, etc.)?

Yes \_\_\_\_\_ No \_\_\_\_\_ (*If no, skip to question 18*)

16) If yes, please note which device(s) and describe, if possible, the circumstances below.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

17) At what age did you first start to notice this apparent effect?

Age \_\_\_\_\_ Don't recall \_\_\_\_\_

18) Are you physically affected in advance by changing weather, such as approaching thunderstorms?

Yes \_\_\_\_\_ No \_\_\_\_\_ Unsure \_\_\_\_\_

19) Have you ever experienced any unusual or paranormal phenomena? (**if no skip to question 25**)

Yes \_\_\_\_\_ No \_\_\_\_\_ Unsure \_\_\_\_\_

20) Check those that best describe the sensation or phenomena referred to in question 19.

Visual Apparition	_____	Telepathy	_____	Unexplainable weakness of body parts	_____
Feeling of not being alone	_____	Precognition	_____	Overwhelming feelings/emotions	_____
Auditory phenomena	_____	Tactile phenomena	_____	Unexplainable skin irritation	_____
Olfactory phenomena	_____	Overwhelming fatigue	_____	Unexplainable muscle pain	_____
Lights/energy	_____	Objects moving	_____	Unusual head pressure	_____

21) Briefly describe the sensation or phenomenon experienced.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

22) Has this experience or something similar to it recurred?

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Yes \_\_\_\_ No \_\_\_\_ Not sure \_\_\_\_

23) If yes, how frequently has this type of experience recurred?

Once \_\_\_\_ Rarely \_\_\_\_ Intermittently \_\_\_\_ Frequently \_\_\_\_

24) Has anyone you know (even a pet) reacted similarly in the circumstances you described?

Yes \_\_\_\_ No \_\_\_\_ Not sure \_\_\_\_

25) Is there anything further you would like to add that might be relevant to this survey?

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26) Do you believe in the existence of ghosts?

Definitely yes \_\_\_\_ Yes \_\_\_\_ Uncertain \_\_\_\_ No \_\_\_\_ Definitely no \_\_\_\_

27) Do you believe that the deceased can communicate with the living?

Definitely yes \_\_\_\_ Yes \_\_\_\_ Uncertain \_\_\_\_ No \_\_\_\_ Definitely no \_\_\_\_

28) Do you believe you have the ability to affect or move objects just by thinking about it?

Definitely yes \_\_\_\_ Yes \_\_\_\_ Uncertain \_\_\_\_ No \_\_\_\_ Definitely no \_\_\_\_

29) How frequently do you experience events that you believe are similar to ESP (acquiring information through means other than the usual 5 senses)?

Everyday \_\_\_\_ Frequently \_\_\_\_ Occasionally \_\_\_\_ Rarely \_\_\_\_ Never \_\_\_\_

## Environmental Sensitivity and Paranormal Experiences

### Appendix A (cont.): Experiences Checklist:

\* For an explanation regarding the rooms numbers on checklist reader if referred to Table 3 in the text

You will visit 10 different rooms while on the tour. The guide will let you know the Room number you are in. While in the room please spend a few moments quietly standing in the room and then report any unusual phenomena that you experience. If you experience any unusual phenomena please check the Yes box and check any of the sensations or phenomena that best describes your experience. If you did not experience any unusual phenomena simply check the No box. At the end of the survey please provide a brief description (in your own words) of the strongest or most memorable unusual phenomena or sensation you experienced. Please ..... report all unusual experiences, no matter how faint they are.

..... include all types of experiences, e.g.: unusual changes in temperature, smells, tastes, a sense of presence, sounds & feelings.

..... if you had an experience fill in the box in regards to your level of belief that the experience was due to a ghost

..... if necessary, continue on back of sheet.

Room Number	Check <u>ANY</u> description that best describes the sensation or phenomena	Do you think your unusual experience was due to a ghost?
<p><b>Room # 2</b></p> <p>Did you experience any unusual phenomena?</p> <p>Yes ___ No ___</p>	<p>Visual Apparition _____</p> <p>Sense of a presence _____</p> <p>Auditory phenomena _____</p> <p>Dizziness/Headache ___</p> <p>Objects moving _____</p> <p>Overwhelming feelings/emotions _____</p> <p>Unexplainable weakness of body parts _____</p> <p>Muscle Pain _____</p> <p>Other (explain) _____</p> <p>Overwhelming fatigue _____</p> <p>Skin irritation _____</p> <p>Tactile phenomena _____</p> <p>Unusual Lights/energy _____</p> <p>Change in temperature _____</p> <p>Tingling/Burning sensation _____</p> <p>Nausea _____</p> <p>Unexplained pressure _____</p>	<p>___ Definitely Yes</p> <p>___ Probably Yes</p> <p>___ Uncertain</p> <p>___ Probably No</p> <p>___ Definitely No</p>
<p><b>Room # 3</b></p> <p>Did you experience any unusual phenomena?</p> <p>Yes ___ No ___</p>	<p>Visual Apparition _____</p> <p>Sense of a presence _____</p> <p>Auditory phenomena _____</p> <p>Dizziness/Headache ___</p> <p>Objects moving _____</p> <p>Overwhelming feelings/emotions _____</p> <p>Unexplainable weakness of body parts _____</p> <p>Muscle Pain _____</p> <p>Other (explain) _____</p> <p>Overwhelming fatigue _____</p> <p>Skin irritation _____</p> <p>Tactile phenomena _____</p> <p>Unusual Lights/energy _____</p> <p>Change in temperature _____</p> <p>Tingling/Burning sensation _____</p> <p>Nausea _____</p> <p>Unexplained pressure _____</p>	<p>___ Definitely Yes</p> <p>___ Probably Yes</p> <p>___ Uncertain</p> <p>___ Probably No</p> <p>___ Definitely No</p>
<p><b>Room # 4</b></p> <p>Did you experience any unusual phenomena?</p> <p>Yes ___ No ___</p>	<p>Visual Apparition _____</p> <p>Sense of a presence _____</p> <p>Auditory phenomena _____</p> <p>Dizziness/Headache ___</p> <p>Objects moving _____</p> <p>Overwhelming feelings/emotions _____</p> <p>Unexplainable weakness of body parts _____</p> <p>Muscle Pain _____</p> <p>Other (explain) _____</p> <p>Overwhelming fatigue _____</p> <p>Skin irritation _____</p> <p>Tactile phenomena _____</p> <p>Unusual Lights/energy _____</p> <p>Change in temperature _____</p> <p>Tingling/Burning sensation _____</p> <p>Nausea _____</p> <p>Unexplained pressure _____</p>	<p>___ Definitely Yes</p> <p>___ Probably Yes</p> <p>___ Uncertain</p> <p>___ Probably No</p> <p>___ Definitely No</p>
<p><b>Room # 6</b></p> <p>Did you experience any unusual phenomena?</p> <p>Yes ___ No ___</p>	<p>Visual Apparition _____</p> <p>Sense of a presence _____</p> <p>Auditory phenomena _____</p> <p>Dizziness/Headache ___</p> <p>Objects moving _____</p> <p>Overwhelming feelings/emotions _____</p> <p>Unexplainable weakness of body parts _____</p> <p>Muscle Pain _____</p> <p>Other (explain) _____</p> <p>Overwhelming fatigue _____</p> <p>Skin irritation _____</p> <p>Tactile phenomena _____</p> <p>Unusual Lights/energy _____</p> <p>Change in temperature _____</p> <p>Tingling/Burning sensation _____</p> <p>Nausea _____</p> <p>Unexplained pressure _____</p>	<p>___ Definitely Yes</p> <p>___ Probably Yes</p> <p>___ Uncertain</p> <p>___ Probably No</p> <p>___ Definitely No</p>

## Environmental Sensitivity and Paranormal Experiences

<p><b><u>Room # 8</u></b></p> <p>Did you experience any unusual phenomena?</p> <p>Yes ____ No ____</p>	<p>Visual Apparition _____</p> <p>Sense of a presence _____</p> <p>Auditory phenomena _____</p> <p>Dizziness/Headache _____</p> <p>Objects moving _____</p> <p>Overwhelming feelings/emotions _____</p> <p>Unexplainable weakness of body parts _____</p> <p>Muscle Pain _____</p> <p>Other (explain) _____</p> <p>Overwhelming fatigue _____</p> <p>Skin irritation _____</p> <p>Tactile phenomena _____</p> <p>Unusual Lights/energy _____</p> <p>Change in temperature _____</p> <p>Tingling/Burning sensation _____</p> <p>Nausea _____</p> <p>Unexplained pressure _____</p>	<p>_____ Definitely Yes</p> <p>_____ Probably Yes</p> <p>_____ Uncertain</p> <p>_____ Probably No</p> <p>_____ Definitely No</p>
<p><b><u>Room # 9</u></b></p> <p>Did you experience any unusual phenomena?</p> <p>Yes ____ No ____</p>	<p>Visual Apparition _____</p> <p>Sense of a presence _____</p> <p>Auditory phenomena _____</p> <p>Dizziness/Headache _____</p> <p>Objects moving _____</p> <p>Overwhelming feelings/emotions _____</p> <p>Unexplainable weakness of body parts _____</p> <p>Muscle Pain _____</p> <p>Other (explain) _____</p> <p>Overwhelming fatigue _____</p> <p>Skin irritation _____</p> <p>Tactile phenomena _____</p> <p>Unusual Lights/energy _____</p> <p>Change in temperature _____</p> <p>Tingling/Burning sensation _____</p> <p>Nausea _____</p> <p>Unexplained pressure _____</p>	<p>_____ Definitely Yes</p> <p>_____ Probably Yes</p> <p>_____ Uncertain</p> <p>_____ Probably No</p> <p>_____ Definitely No</p>
<p><b><u>Room # 13</u></b></p> <p>Did you experience any unusual phenomena?</p> <p>Yes ____ No ____</p>	<p>Visual Apparition _____</p> <p>Sense of a presence _____</p> <p>Auditory phenomena _____</p> <p>Dizziness/Headache _____</p> <p>Objects moving _____</p> <p>Overwhelming feelings/emotions _____</p> <p>Unexplainable weakness of body parts _____</p> <p>Muscle Pain _____</p> <p>Other (explain) _____</p> <p>Overwhelming fatigue _____</p> <p>Skin irritation _____</p> <p>Tactile phenomena _____</p> <p>Unusual Lights/energy _____</p> <p>Change in temperature _____</p> <p>Tingling/Burning sensation _____</p> <p>Nausea _____</p> <p>Unexplained pressure _____</p>	<p>_____ Definitely Yes</p> <p>_____ Probably Yes</p> <p>_____ Uncertain</p> <p>_____ Probably No</p> <p>_____ Definitely No</p>
<p><b><u>Room # 15</u></b></p> <p>Did you experience any unusual phenomena?</p> <p>Yes ____ No ____</p>	<p>Visual Apparition _____</p> <p>Sense of a presence _____</p> <p>Auditory phenomena _____</p> <p>Dizziness/Headache _____</p> <p>Objects moving _____</p> <p>Overwhelming feelings/emotions _____</p> <p>Unexplainable weakness of body parts _____</p> <p>Muscle Pain _____</p> <p>Other (explain) _____</p> <p>Overwhelming fatigue _____</p> <p>Skin irritation _____</p> <p>Tactile phenomena _____</p> <p>Unusual Lights/energy _____</p> <p>Change in temperature _____</p> <p>Tingling/Burning sensation _____</p> <p>Nausea _____</p> <p>Unexplained pressure _____</p>	<p>_____ Definitely Yes</p> <p>_____ Probably Yes</p> <p>_____ Uncertain</p> <p>_____ Probably No</p> <p>_____ Definitely No</p>
<p><b><u>Room # 18</u></b></p> <p>Did you experience any unusual phenomena?</p> <p>Yes ____ No ____</p>	<p>Visual Apparition _____</p> <p>Sense of a presence _____</p> <p>Auditory phenomena _____</p> <p>Dizziness/Headache _____</p> <p>Objects moving _____</p> <p>Overwhelming feelings/emotions _____</p> <p>Unexplainable weakness of body parts _____</p> <p>Muscle Pain _____</p> <p>Other (explain) _____</p> <p>Overwhelming fatigue _____</p> <p>Skin irritation _____</p> <p>Tactile phenomena _____</p> <p>Unusual Lights/energy _____</p> <p>Change in temperature _____</p> <p>Tingling/Burning sensation _____</p> <p>Nausea _____</p> <p>Unexplained pressure _____</p>	<p>_____ Definitely Yes</p> <p>_____ Probably Yes</p> <p>_____ Uncertain</p> <p>_____ Probably No</p> <p>_____ Definitely No</p>
<p><b><u>Room # 19</u></b></p> <p>Did you experience any unusual phenomena?</p> <p>Yes ____ No ____</p>	<p>Visual Apparition _____</p> <p>Sense of a presence _____</p> <p>Auditory phenomena _____</p> <p>Dizziness/Headache _____</p> <p>Objects moving _____</p> <p>Overwhelming feelings/emotions _____</p> <p>Unexplainable weakness of body parts _____</p> <p>Muscle Pain _____</p> <p>Other (explain) _____</p> <p>Overwhelming fatigue _____</p> <p>Skin irritation _____</p> <p>Tactile phenomena _____</p> <p>Unusual Lights/energy _____</p> <p>Change in temperature _____</p> <p>Tingling/Burning sensation _____</p> <p>Nausea _____</p> <p>Unexplained pressure _____</p>	<p>_____ Definitely Yes</p> <p>_____ Probably Yes</p> <p>_____ Uncertain</p> <p>_____ Probably No</p> <p>_____ Definitely No</p>

**Please provide a brief description (in your own words) of the strongest or most memorable unusual phenomena or sensation you experienced (use back of paper if necessary).**

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## Appendix B: Room Categorizations and Actual Mean Readings

Room Categorization	Mean Readings (milliguass)
High EMF	<b>3.274</b>
High EMF	<b>3.081</b>
High EMF	<b>2.982</b>
High EMF	<b>2.376</b>
Borderline	<b>1.494*</b>
Borderline	<b>1.434*</b>
Low EMF	<b>1.288</b>
Low EMF	<b>1.224</b>
Low EMF	<b>1.195</b>
Low EMF	<b>0.582</b>

Note. \* signifies borderline rooms that did not meet cut-off criteria.