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THINGS THAT GO BUMP IN THE LITERATURE: AN ENVIRONMENTAL APPRAISAL OF “HAUNTED HOUSES”

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Ghost, Haunt, Anomalous experience, Environmental sensitivities, Phenomenology

Abstract

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Our review of the past 20-years of research on anomalous experiences attributed to “haunted houses” revealed a paucity of studies on environmental factors posited as conscious-stimulants or unconscious-stimulants of percepts. To date, most research in this domain has considered six ambient variables: embedded (static) cues, lighting levels, air quality, temperature, infrasound, and electromagnetic fields. Their relation to the onset or structure of witness reports showed mostly null, though sometimes inconsistent or weak effects. However, such research is in its infancy and new designs are needed to account better for environmental and architectural phenomenology. Future research should therefore explore four issues: (i) more consistent and precise measurements of discrete ambient variables; (ii) the potential role of “Gestalt influences” that involve holistic or collective environmental effects; (iii) individual differences in attentional or perceptual sensitivities of witnesses to environmental variables; and (iv) the role of attitudinal and normative influences in the interpretation of environmental stimuli. In this way, investigators can elucidate more robustly the explanatory power of evolutionary-environmental models for these anomalous episodes and related phenomena.

Contribution to the field

Surveys indicate that anomalous experiences traditionally attributed to “ghosts and haunts” are an ongoing and significant behavioral phenomenon. This paper is apparently the first systematic review of discrete ambient and transient physical variables associated with these reports in non-clinical samples. We evaluated the past 20-years of evidence in support of previous arguments that implicate causal mechanisms grounded in orthodox environmental and architectural phenomenology. Our effort revealed sparse empirical research that clarifies the question. However, the literature referenced six specific variables that could potentially serve as conscious or unconscious stimulants of percepts under certain circumstances or in select cases. Overall, we learned that studies in this domain that draw on environmental psychology are too limited in number, scale, and scope to serve as a robust general explanation. The gaps in this literature help to identify new directions for research in naturalistic settings that should better explain the role of bidirectional influences or enactive processes in these anomalous experiences. In this way, the field can advance closer to a quasi-quantitative model for so-called haunts and perhaps other types of sacred or enchanted spaces.

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ABSTRACT

Our review of the past 20-years of research on anomalous experiences attributed to “haunted houses” revealed a paucity of studies on environmental factors posited as conscious-stimulants or unconscious-stimulants of percipients. To date, most research in this domain has considered six ambient variables: embedded (static) cues, lighting levels, air quality, temperature, infrasound, and electromagnetic fields. Their relation to the onset or structure of witness reports showed mostly null, though sometimes inconsistent or weak effects. However, such research is in its infancy and new designs are needed to account better for environmental and architectural phenomenology. Future research should therefore explore four issues: (i) more consistent and precise measurements of discrete ambient variables; (ii) the potential role of “Gestalt influences” that involve holistic or collective environmental effects; (iii) individual differences in attentional or perceptual sensitivities of witnesses to environmental variables; and (iv) the role of attitudinal and normative influences in the interpretation of environmental stimuli. In this way, investigators can elucidate more robustly the explanatory power of evolutionary-environmental models for these anomalous episodes and related phenomena.

Keywords: *ghost, haunt, anomalous experiences, environmental sensitivities, phenomenology*

THINGS THAT GO BUMP IN THE LITERATURE: AN ENVIRONMENTAL APPRAISAL OF “HAUNTED HOUSES”

INTRODUCTION

It might sound like an amusing or curious claim, but “haunted houses” could be among the oldest problems in orthodox environmental psychology, i.e., the scientific study of the transactions and interrelationships between people and their surroundings, including built, social, natural, and virtual environments. Anthropologists note in this context that haunt experiences have been important parts of shamanism in many early and contemporary societies (Hunter, 2018; McClenon, 2004; Winkelman, 2004). For instance, “shaking tent” rituals involved a special cylindrical lodge or tent to contact spirits, who communicated helpful guidance for hunting, healing, and even locating missing persons. Moreover, as the name suggests, the tent was supposed to tremble mysteriously during the ceremony.

Moreman (2018, p. 29) credited “the earliest haunted house story in Greek or Roman literature” to a 2,000-year-old play by Plautus entitled “Mostellaria” (ca 200-194 B.C.E., translated from Latin as “The Haunted House” with the word *Domus* understood in the title). This fictitious story reveals Roman beliefs about such phenomena (Felton, 1999), which seemingly align well with modern presumptions (Goldstein et al., 2007; Hunter, 2018; Massullo, 2019). Similarly, haunt-type experiences — spontaneous or purposely cultivated — can be found across different societies and eras (Carrington & Fodor, 1951; Gauld & Cornell, 1979/2017; Finucane, 1996; Owen, 1964; Roll, 1977; Tuczay, 2004). As might be expected, the specific sociocultural milieu influences the interpretation of these anomalous episodes and the ways people cope with them (for reviews, see e.g., Houran, 2004; Houran & Lange, 2001b).

HAUNTED HOUSES AS SOCIAL FACTS...AND POSSIBLY MORE

“Haunted house” refers to at least two types of anomalous episodes, which we define in this paper from a phenomenological perspective (Houran et al., 2019a, 2019b; Lange & Houran, 2001a). *Poltergeist disturbances* can be described correspondingly as clusters of unusual “psychological experiences” (e.g., apparitions, sensed presences, hearing voices, and unusual somatic or emotional manifestations) and “physical events” (e.g., apparent object movements, malfunctioning electrical or mechanical equipment, and inexplicable percussive sounds like raps or knocks), which focus around the presence of certain people (for a recent discussion, see Ventola et al., 2019).

Similar psychological and physical anomalies that tend to persist at specific locations are called haunts or *hauntings* (Gauld & Cornell, 1979/2017; Roll & Persinger, 2001). However, a firm distinction between these occurrences is problematic due to their overlapping characteristics (Houran et al., 2019a; Ventola et al., 2019, pp. 145-146) and shared set of psychological and physical anomalies that forms a unidimensional and probabilistic (Rasch) hierarchy (Houran et al., 2019b; Houran & Lange, 2001a; Houran, Wiseman, & Thalbourne, 2002). Thus, a common phenomenon or set of mechanisms might underlie both types of “ghostly episodes.”

Skeptical readers should not trivialize these occurrences, as they can affect several aspects of daily life. Most obviously, ghosts and the supernatural can be important parts of an individual’s religio-cultural worldview (Dyne, 2010; Eaton, 2015, 2019; Hill et al., 2018, 2019). This has implications for social identity theories of social rank, self-esteem, and the reinforced belief systems that individuals hold for explanatory meaning in their lives (e.g., Tajfel & Turner, 1979). Reports of ghosts and haunts may also reinforce and contextualize the anxieties of individuals who are already fearful of the paranormal (de Oliveira-Souza, 2018; Lange & Houran, 1999). Indeed,

the Gallup polls of 1990, 2001, and 2005 revealed that a substantial proportion of respondents believed in ghosts and hauntings (Dagnall, Drinkwater, Denovan, & Parker, 2015; Dagnall, Drinkwater, Parker, & Clough, 2016). The 2005 Gallup poll specifically found that 37% of those surveyed believed that houses could be haunted, and 32% thought that the spirits of dead people could return to certain places or situations (Moore, 2015). Other surveys have reported similar figures (e.g., Lipka, 2015; Pew Research Center, 2009).

Given these belief statistics, it is not surprising that the ghostly reputations of certain places have provoked real estate lawsuits concerning undisclosed “stigmatized properties” (Murray, 2017). In fact, houses rumored to be haunted often suffer significant value diminution, and this is especially true in countries like Taiwan and Hong Kong (China) where haunts have strong cultural associations with bad luck, vengeful ghosts, and ancestral spirit anger (Bhattacharya, Huang, & Nielsen, 2017; Chu, 2016; Emmons, 1982). On the other hand, “haunted” buildings or sites in Western culture are often promoted favorably as enticing tourist destinations (Hanks, 2015; Houran, Hill, Haynes, & Bielski, 2020), and sales transactions of these places can bring higher prices if a paranormal reputation is regarded as a benefit by buyers (Behar, 2017).

Hill et al. (2018) further discussed how entire industries have developed around legend-tripping, i.e., deliberately visiting spooky locations to seek paranormal experiences (Bird, 2002; Holloway, 2010) or virtual excursions pursued via livestreaming videos of exploits by paranormal enthusiasts (Kinsella, 2011). Folklorists might regard such pursuits as examples of “ostension,” that is, acting out or showing the legend narrative in real life (e.g., Manning, 2018). These trends likely relate to broader issues, such as Maddern and Adey’s (2008) concept of *spectro-geographies*. Edensor (2008) nicely described this latter perspective in asserting that “ghosts ‘are a ubiquitous aspect of the phenomenology of place,’ ‘ineffable and quasi-mystical’ dimensions

which emerge in encounters with the material, the mediated, the sensual and the affectual” (p. 331). As such, spectral themes regularly appear in the popular media and academic literature. This helps to promote “ghosts and haunted houses” as pervasive cultural narratives (Bader, 2017; Booker, 2009; Edwards, 2005; Goldstein, Grider, & Thomas, 2007; Lecouteux, 2012), which can act as highly engaging memes (Drinkwater et al., 2019; Hill et al., 2018, 2019).

All told, haunted houses certainly exist as psychological, cultural, economic, and legal realities — with a strong and engaging “brand personality” akin to popular consumer products (Annett et al., 2016; Hill et al., 2018, 2019). Cases are often attributed to overactive imaginations or fraud with various motivations (Ashford, 2017; Nickell, 2012), but independent environmental or physical mechanisms have been demonstrated, or seem likely, in select instances (e.g., Colvin, 2010; Laythe & Houran, 2019; Nickell, 2008; Vinokur, 2005, 2016). The ontological status of haunts beyond that of social facts thus remains an open, intriguing, and legitimate question. Accordingly, our review evaluates the broad explanatory power of environmental psychology for this domain.

METHOD

We reviewed conceptual and empirical research on “ghosts, haunts, and poltergeists” (collectively termed *ghostly episodes*) from environmental perspectives and primarily published since Houran and Lange’s (2001b) seminal anthology, i.e., the years spanning 2001-present. We targeted studies using eighteen keywords: “anomalous experience, apparition, demon, ego-alien intrusions, encounter experiences, ghost, ghost-hunting, haunt, haunting, metachoric experience, paranormal belief, paranormal experience, poltergeist, possession, séance, sensed presence, sitter-group work, and spirit.” The search was limited to publications written in English.

Our procedure encompassed electronic search engines and repositories (i.e., Google Scholar, PsycINFO, and ResearchGate), and we examined titles, abstracts, reference lists, and publications to identify relevant publications. Finally, the authors included pertinent studies cited in the works sourced via the search process. Our methodology yielded sixty-six articles cited. Of these, ~55% ($n = 36$) appeared in parapsychology journals or niche sources versus ~45% in mainstream journals or sources ($n = 30$). This distribution appears reasonably balanced from an ideological standpoint, but this literature set averages only to three articles per year. This implies very slow and limited progress in examining the role of environmental factors in haunt-type episodes.

RESULTS

Six discrete variables are clearly referenced within the restricted literature: (i) embedded (static) cues, (ii) lighting levels, (iii) air quality, (iv) temperature, (v) infrasound, and (vi) electromagnetic fields. These factors are often characterized as either *conscious-stimulants* or *unconscious-stimulants* of anomalous experiences. Conscious stimulants are variables that can overtly capture attention and be interpreted as “ghostly.” Alternatively, unconscious (or non-conscious) stimulants refer to stimuli that are unwittingly or passively sensed and stimulate unusual or anomalous perceptions. Note that some variables might act as either stimulant.

Embedded (Physical or Static) Cues in the Environment

Content or thematic analyses of haunt narratives have suggested that the perceptual details of percipients’ experiences are often congruent with contextual variables accompanying the situation (Harte, 2000; Houran, 2000). These potential context effects include tangible *embedded cues* in the physical environment, such as the mysterious aroma of *lilacs* in a room with a prominent *violet* hue or hearing mysterious *waltz music* in an empty *ballroom*. Unfortunately, it

seems that few ecologically valid studies have empirically tested the premise that haunt experiences might involve such a “room with a clue.”

However, there are two exceptions in this respect. *First*, Houran (2002) examined the real-time anomalous experiences of research participants in tandem with salient environmental and aesthetic characteristics of “haunted vs un-haunted” rooms in a historic mansion with a discreet reputation for paranormal activity. For instance, previous witnesses often reported “sensed presences” in particular areas, and it was speculated that perhaps these accounts correlated with those rooms containing the most artwork, i.e. portrait paintings that conceivably created situations where participants were literally “being watched.” Nevertheless, analyses found no statistically significant differences between the haunted and un-haunted areas in terms of the number of pieces of artwork (specifically paintings and sculptures), as well as temperature, humidity, or the number of air vents associated with each room. Consequently, there was no evidence that these overt environmental features acted as contextual variables to stimulate or shape participants’ experiences.

Next, Terhune, Ventola, and Houran (2007) improved on the basic procedure above in their field investigation of a reputed haunt (i.e., “target house”) at an unpublicized private residence in comparison to a nearby “control house.” In particular, these researchers measured physical cues such as windows, mirrors, and the quantity and type of artwork (with and without human forms) using a between and within research design—i.e., (i) potential differences between the target and control houses, and (ii) potential differences within “haunted and un-haunted” areas of the control house. These physical cues were also examined in relation to the presence of apparent photographic “anomalies” obtained across different film media during the study and rated by independent judges.

Similar to Houran (2002), no statistically significant effects ($p < .05$) were found for the environmental variables. However, it might be worth noting that there was a suggestive trend ($p < .07$, two-tailed) for the control house ($M = 3.57$, $SD = 3.10$) to contain *more* mirrors than the target house ($M = 1$, $SD = 1.41$). This finding might seem surprising and counterintuitive, since mirrors and reflective surfaces in general are anecdotally and empirically associated with anomalous experiences (e.g., Caputo, 2010a, 2010b, 2013, 2015, 2016, 2017, 2019; Caputo et al., 2012). This generally positive correlation has several interpretations. For instance, mirrors might serve as embedded (physical) cues that reinforce expectancy or suggestion effects. However, evidence indicates that reflective surfaces can directly stimulate perceptual aberrations, independently of suggestion (Caputo, 2010a, in press).

“Psychomanteum” studies and mirror-gazing (and eye-gazing) phenomena are a fascinating niche subject within consciousness studies that can aid model-building or theory-formation of haunt-type experiences (cf. Radin, & Rebman, 1996). For example, based on his synthesis of all previous findings from eye-to-eye-gazing and mirror-gazing studies, Caputo (2019) proposed three distinct “clusters” or factors of anomalous experience that derive from different brain circuits stimulated during these facilitated sessions. He validated this idea with a questionnaire study of the strength and frequency of a relatively large list of various “apparitional” and anomalous phenomena. This list generally aligned to Baker’s (2002) definition of apparitions, which itself was adapted from Thalbourne’s (1982) glossary: “A sensory experience in which there appears to be present a person or animal (deceased or living) who is in fact out of sensory range of the experient...” (p. 110).

A principal component analysis and quartimax rotation suggested that anomalous experiences during mirror- and eye-gazing sessions form three independent factors (Caputo, 2019).

This same three-factor structure was confirmed via other methods like polychoric, alpha, etc., which might suggest that these perceptual anomalies derive from three distinct states of consciousness: (i) *depersonalization* (i.e., changes of multisensory integration on bodily-self, hence out-of-body “presence”); (ii) *derealization* (i.e., changes in sensory maps of visual processing, hence deformations in perceptions), and (iii) *dissociative identity* (i.e., changes of identity-self, hence apparitions of strange personalities in place of the real other individual or in place of the subject’s regular self-face reflected in the mirror.). The balance among these three processing levels apparently varies among observers. However, the feeling of another “being or entity” — “real” and with self-agency — may correspond more specifically to the surfacing of a dissociative identity, which has been “projected” beyond the reflective mirror into the face of the strange other.

Lighting Levels

Lighting levels, as well as the objective measurement of illumination within haunted locations, is a scenario where tradition or “common sense” have maybe prevented detailed study in favor of foregone conclusions. In terms of tradition, low-light settings constitute normal operating procedures for many field investigations (e.g., Houran, Wiseman, & Thalbourne, 2002; Laythe & Owen, 2013), as well as spiritualistic practice (Laythe et al., 2017). Likewise, the horror film genre is an obvious example of darkness being equated to “spookiness or creepiness.” Similar to mirrors; therefore, “darker” settings likely bolster expectancy set.

However, few studies have directly examined lighting levels in relation to haunts. One example is Terhune et al. (2007) who found that overall lighting levels were not significantly different in an allegedly “haunted” site compared to a “control” site. Yet, examination of the means and standard deviations do show lower mean levels of lighting (F-stop aperture: $M = 4.07$ vs. 4.77)

and much less variability ($SD = 0.19$ vs. 1.19), indicating an overall lower level of lighting (albeit non-significant) at the haunted location. A serious limitation in Terhune et al. (2007); however, was that their measurements were not made simultaneously with real-time reports of anomalous experiences. In contrast, Wiseman, Watt, Stevens, Greening, & O’Keeffe (2003b) measured the lighting levels both inside and directly outside the test areas of the “haunted” South Bridge Vaults (Edinburgh, Scotland). These researchers found significant associations between the lighting outside of target areas and anomalous experiences reported by participants, as well as with those locations with prior history of ghostly reports.

Nevertheless, “lighting levels” could be the wrong term for these findings if the absence of light or *sensory deprivation* is instead the principal effect. An oft-used explanation for ghostly anomalies as a function of darkness is “visual pareidolia,” or the tendency to make or perceive meaningful patterns in visual noise. Nees and Phillips (2015) similarly argued that auditory pareidolia accounted for so-called “electronic voice phenomena” (EVP) and related experiences in some haunt episodes. Evidence supports this model, although it typically derives from research with patients suffering from psychosis or psychotic-related disorders like dementia. For instance, Mamiya et al. (2016) has standardized a short-form visual pareidolia test for use with dementia patients, which correlated positively ($r = 0.42$) with separate measures of pareidolia. This test provides a series of “white noise and blurred image” pictures for participants to interpret. Notably, they do not measure low lighting images, but earlier work using this procedure (Uchiyama et al., 2012) showed significant increases in pareidolia hallucinations with dementia patients versus controls.

Still, the populations and methodologies in these studies undermine the generalizability of their findings for non-clinical samples or haunt-related contexts. More closely related to the dark

bowers of a haunted location are Daniel and Mason's (2015) sensory deprivation studies. These researchers placed participants (scoring either low or high on psychotic-like experience) in a sensory deprivation chamber for sound and light. Both conditions reported a significant increase in psychotic-like experiences because of sensory deprivation, while demonstrating a lack of hallucination as a function of either suggestibility or fantasy proneness.

From the above and a more general environmental perspective, lighting (or a lack thereof) seems likely to contribute to experiences deemed paranormal or ghostly. However, two caveats are important here. *First*, we note that "light anomalies" or other curious outcomes or artifacts captured on film or video (Lange & Houran, 1997b; Laythe & Owen, 2013; Mayer, 2014; Schwartz & Creath, 2005; Storm, 2001; Ventola, 2002) or measured outside the visible light spectrum (Joines, Baumann, & Kruth, 2012) are not, strictly speaking, accounted by pareidolia-like effects. Related to the former, Wilson, Williams, Harte, and Roll (2010) demonstrated transient decreases in both infrared and visible light during environmental measurement of a single séance session of approximately 95 minutes. As such, further need studies are needed to account for low-light pareidolia phenomena, while controlling for other "haunting" environmental factors (e.g., Jawer, Massullo, Laythe, & Houran, 2020).

Air Quality

Government agencies describe how generally clean the air is, and what associated health effects might be a concern, via the "Air Quality Index" (AQI: see e.g., <https://airnow.gov> and <https://bit.ly/306pDEc>). Particularly, there are five major air pollutants regulated by the Clean Air Act (USA): (i) ground-level ozone, (ii) particle pollution [e.g., acids (such as nitrates and sulfates), organic chemicals, metals, soil or dust particles, and allergens (e.g., fragments of pollen or mold spores)], (iii) carbon monoxide, (iv) sulfur dioxide, and (v) nitrogen dioxide. For each of these, the

Environmental Protection Agency has established national air quality standards and calculates the AQI to protect public health.

Of these categories, we found references only to particle pollution and carbon monoxide in the haunt literature. For instance, *humidity* or water vapor is a contributing factor to mold growth (Environmental Protection Agency, 2017). Readily available articles have bolstered public awareness about acute and chronic illnesses that can result from exposure to biotoxins made by molds, dinoflagellates, spirochetes, and blue-green algae (e.g., Ackerly, 2014; Shoemaker, Schaller, & Schmidt, 2005; Tsafirir, 2017). The ensuing symptoms sometimes parallel the psychological experiences that characterize haunts, e.g., disorientation, mood swings, temperature regulation or dysregulation problems, and tingling (cf. Tsafirir, 2017, para. 8).

As many haunted locations are older structures that are prime environments to contain molds or other indoor air quality problems, some authors (Clarkson University, 2015; Kane, 2015) have proposed that ghostly experiences are indicative of exposure to toxic molds. To our knowledge, this speculation has yet to be validated by research showing differences in mold or indoor air quality between haunted and control locations. Furthermore, the available evidence is not persuasive that haunts are indirectly related to humidity levels (or mold growth). Terhune et al.'s (2007) study of a haunt (i.e., “target”) and control house revealed significantly higher humidity levels in the target house, but there were no statistically significant differences in humidity levels between “haunted” versus “un-haunted” rooms of the target house. There were likewise no significant differences in humidity levels (or the number of air vents) in Houran’s (2002) investigation of “haunted and un-haunted” rooms at a historic mansion.

Broadly speaking, studies by professional parapsychologists and amateur paranormal enthusiasts have omitted the measurement of humidity. This is not to say that some findings

pertinent to haunt-type experiences are completely absent. To be sure, “It’s not the heat, it’s the humidity” is an old adage with some empirical support. For instance, Ding, Berry, and Bennett (2016) found that humidity significantly compounds the negative association between hot weather and mental health demonstrating between a .01% to .05% increase in negative mental health effects based on logit model prediction of heat and humidity. As such, humidity may exacerbate mental conditions conducive to subjective haunt-type experiences. However, the contribution of humidity to mental health appears to be small.

Conversely, the role of carbon monoxide has been clearly substantiated in some reports. Most famously, Wilmer (1921) published a dramatic case study of a couple who moved into a “large, rambling, high-studded house, built around 1870, and much out of repair.” The pair soon began having anomalous experiences — i.e., unusual bouts of headaches, strange sensations, and feelings of listlessness, as well as hearing phantom footsteps and seeing mysterious figures. These complaints closely matched the classic signs or symptoms of a “paranormal haunt” (Houran et al., 2019a, 2019b), but eventually they were traced to carbon monoxide poisoning from a faulty furnace.

According to The Body Odd (2009), a more recent case in 2005 reportedly involved a woman who was found delirious and hyperventilating after seeing a “ghost” while taking a shower. Investigators discovered a new gas water heater had been improperly installed and thus flooded the house with carbon monoxide. Beyond these two examples (and only citation within our literature set), the available anecdotal evidence does not implicate carbon monoxide poisoning in most witness reports. Telling in this respect is that Joe Nickell, Ph.D., well-known skeptic and researcher of paranormal claims for 30+-years, stated that he has “...never encountered this scenario” in his investigations to date (The Body Odd, 2009, para. 18).

Temperature

Ghostly episodes can, but rarely, involve reports of increases in temperature (Houran et al., 2019b). For example, Nickell (2001) discussed one eyewitness account in which a phantom silhouette was reported by a naval captain in an unbearably hot bedroom. However, the most commonly reported temperature “anomalies” in haunt-type experiences are so-called “cold spots,” i.e., a temperature drop, or at the very least, a distinct perception of localized coldness (Parsons & O’Keeffe, 2006). Williams, Ventola, and Wilson’s (2008) online primer for paranormal enthusiasts noted that the variable duration of cold spots commonly reported in haunted houses can range from a “fleeting feeling, or they may be persistent over time” (p. 1). Parapsychologists acknowledge that these subjective (unverifiable) “temperature drops or changes” at haunts can derive from predictable physiological reactions to fear-related scenarios (O’Keeffe & Parsons, 2010). Still, there has been a paucity of laboratory research to verify the hypothesized causes of temperature anomalies.

Experimental work on related anomalous experiences has documented reports of temperature drops, such as with séance room phenomena (Wiseman, Greening & Smith, 2003a). O’Keeffe and Parsons (2010) critically discussed one of the few studies in the last 25 years — conducted by Radin and Rebman (1996) — that tested the correlation between temperature changes in the local physical environment and participants’ mental states (albeit via the induction of an anomalous experience). The study’s protocol involved an instrumented “psychomanteum chamber,” i.e., a small and dimly lit room with a mirror strategically placed to induce experiences of “after-death communication” (Root, 2015). O’Keeffe and Parsons (2010, p. 113) noted that “some of the significant ambient temperature and physiological correlations were possible artifacts

of a common downward drift in temperature” exacerbated by the floor-level placement of the computerised thermometer.

Terhune et al.’s (2007) extensive field study of an allegedly haunted residence found that ambient temperature measurements differed significantly (colder in “paranormally-active” areas) compared to a nearby designated control house, even when possible confounds were considered (e.g. number of windows etc.). Despite this, there was little difference *within* the haunted house itself, i.e. no relationship between areas associated with anomalous experiences and temperature readings. Similarly, a field-based series of experiments conducted at Hampton Court Palace and Edinburgh Vaults examined the *psychological mechanisms* that may underlie participants’ haunt experiences (cf. Houran et al., 2002), but also accumulated a wealth of data on *environmental variables* (Wiseman et al., 2003b). They found no significant relationship between temperature level and the number of anomalous experiences that people reported (Wiseman et al., 2003b).

Infrasound

Leventhall, Pelmear, and Benton (2003) defined infrasound as audio frequency energy that falls below the range of normal hearing, typically 20Hz. It can be characterized simplistically as a “hum you cannot hear.” Persinger (2014) noted the prevalence of both ambient infrasound within the environment (via natural phenomena such as geomagnetic activity, wind, volcanic eruptions etc.) and man-made infrasound (e.g. aircraft, large machinery, air movement in duct systems). The vibroacoustic effect of a wider spectrum of sound, low-frequency sound (typically 20-160Hz), within a paranormal context has been argued from a physics perspective in only two key articles (Vinokur, 2005, 2016). In these papers, Vinokur described the clear role of naturally occurring vibroacoustic phenomena in producing poltergeist-type effects (e.g., rattling windows, whispering galleries, remote noises, and vibrations, etc). The proposed role of infrasound; however, in haunt-

type experiences follows a theme of research two decades ago starting with Tandy and Lawrence (1998), who posited a causal link between infrasound and apparitional experiences, and specifically noting infrasound around 19Hz that appeared to cause visual effects derived from eyeball-vibration that might be interpreted as a ghostly sighting.

This central hypothesis was then tested a few years later by surveying the presence of ambient infrasound in a reputedly haunted 14th Century cellar beneath a tourist information centre in Coventry (Tandy, 2000). Parsons (2012), however, reports on his series of infrasound measurements conducted at the same venue in 2006 which did not support Tandy's (2000) findings and which found, instead, a "broad range of frequencies exceeding 30dBS between 20Hz and 2KHz, with a peak at 44dBS at 5.7Hz," (Parsons, 2012, p. 165).

Similar concerns about Tandy's original findings (Tandy & Lawrence, 1998; Tandy, 2000) have been voiced, i.e.,: (i) the lack of detail provided about the infrasound measurement specifications (e.g., weighting filter unspecified, room dimensions not taken into account, etc., Parsons, 2012), and (ii) the lack of supporting published evidence showing the physiological effects of such weak infrasound levels (Braithwaite & Townsend, 2006). This lessens the significance of the role of infrasound (and specifically around 19Hz) in explaining haunt-type experiences. Additionally, Parsons (2012; Parsons & Cooper, 2015) reported on a number of studies carried out at various haunts across the UK (i.e., Merseyside, Edinburgh), which found high ambient-levels of infrasound (at varying frequencies) as being a contributing factor to haunt experiences but not supportive of Tandy and Lawrence's (1998) focus around 19Hz as causing visual disturbances and hence apparitional experiences.

Nevertheless, there are similarities between the reported physical and psychological effects of infrasound in the lab and those reported anecdotally by individuals having haunt experiences

(O’Keeffe & Parsons, 2010; Parsons, 2012). Recent studies examining the effect of pure infrasound tones at high sound-pressure levels on participants have reported effects such as headaches, ear pressure, tiredness, change in heart rate, disorientation, and complications arising from the impact on the inner ear (e.g., Chen & Hanmin, 2004; Hansen, 2007).

Despite the above reservations, a series of unusual highly publicized studies have been conducted since 2001 to examine Tandy and Lawrence’s (1998) original hypothesis. For example, music concerts that incorporated man-made infrasound were conducted in a venue in Liverpool and repeated at the Royal Festival Hall in London (Arenda & Thackara, 2003). In a pre-specified number of pieces during the concert, infrasound was played and the emotional response to the music measured. Although the environment and social context may have played a factor in the way the audience responded to the music, counterbalancing of the “infrasound” presence over two performances negated some of this influence. In addition to questionnaire-based responses, “free response sections” provided a rich source for more qualitative responses. Reactions ranged from minor changes in low arousal emotions such as *calm* and *sleepy* to more noticeable variation in others such as *aroused* and *excited*. These were accompanied by experiences that also varied in intensity from “slight agitation” and “slight light-headedness” to more powerful ones: “increased heartbeat”; “facial tingle”; and “a distinct sense of presence,” (Arenda & Thackara, 2003).

A similar approach to infrasound generating and testing was used in two further public performances in 2006 and 2010 where the focus was on infrasound at 18.9Hz at a sound pressure level exceeding 90DBs (Forsyth & Pollard, 2019). Although there were a number of additional environmental factors incorporated into the performance (e.g. subliminal suggestion), some anecdotal accounts from participants and audience members in response to the infrasound generating included “physical discomfort, anxiousness, and feeling ill-at-ease,” yet it is unclear

whether these responses were due to the generated infrasound or the ambient infrasound already present (Parsons, 2012).

Between the above two performances, a novel test of Tandy's hypothesis involved the construction of a room which became "haunted" through the systematic variation of two key environmental factors: *electromagnetic fields* and *infrasound* (French, Haque, Bunton-Stasyshyn & Davis, 2009). In this "Haunt" Project" (as the study was titled), participants were aware that they may have anomalous experiences. They spent 50 minutes in the specially constructed room and were asked to record on a floor plan the location of their experiences. Depending on the condition the participants were assigned to, they may have been exposed to nothing, infrasound, complex electromagnetic fields, or both environmental variables.

In terms of the infrasound aspect of the study, despite participants reporting a number of anomalous sensations that correlated with lab exposure to infrasound, the number of experiences was unrelated to the experimental conditions. The authors, therefore, proposed that the simplest explanation for the reported experiences was participants' *suggestibility* (French et al., 2009). Parsons and Cooper (2015), however, are critical of the results given concerns about the production of infrasound (combining two sine waves of 18.9Hz and 22.3Hz), the lack of detail regarding the sound recording equipment, and the absence of ambient infrasound data.

Electromagnetic Fields (EMFs)

It is well publicized, even sensationalized, that haunt-type experiences are presumably associated with perturbances in geomagnetic or EMF activity. In fact, it can be argued that many findings from the various types of instrumentation used in fieldwork studies of haunts represent EMF effects (Houran & Lange, 1998). Interested readers are therefore encouraged to consult seminal overviews on this topic for detailed information on the inherent technicalities involved

and the corresponding debates about the issues of measurement and interpretation of research findings (see e.g., Braithwaite, 2008, 2010, 2011; Persinger & Koren, 2001; Williams, Ventola, & Wilson, 2007).

By way of explanation, *geomagnetic fields* (GMF) are DC fields that are largely generated through the fluid motion of the Earth's molten iron core (Buffett, 2000). Although the GMF of the Earth averages around 500-milliGauss (MG), and typically less than 10 hz, there are a number of things that can produce notable changes in the strength of the GMF in certain areas of the planet. These can include seismic activity along fault zones (Persinger, 1985), electrical activity during thunderstorms, and large amounts of magnetic or electrically conductive minerals present in the surrounding geology of a given area. In addition, increases in cosmic radiation from space, as a result of sunspots, solar flares, or similar stellar phenomena, may sometimes greatly change the GMF strength and lead to geomagnetic storms as this radiation interacts with the boundary of the GMF in the upper atmosphere (Lyon, 2000).

Conversely, *electromagnetic fields* are AC fields that are typically artificially produced by electrical power currents, and in some instances, produced naturally by geophysical sources (e.g., electricity produced via seismic pressure on conductive rock along fault zones, Persinger, 1985, 1987), as well as by very low frequency atmospherics, which are electromagnetic pulses produced from electrical discharges after a lightning strike that average around 0.6-MG (Schienle, Stark, & Vaitl, 1998).

Ultimately, GMF and EMF are artificial distinctions of different frequencies of the electromagnetic spectrum at its slowest frequencies. The distinction of the two is typically made by the frequency of the fields, where GMF is generally considered to reside in the single-digits of frequency on the EM spectrum, and EMF is typically shorthand for mains frequency (i.e. power

lines) magnetic fields produced at either 60 or 50 hz, depending on your country of origin. Nowhere are the limitations of technology and measurement more problematic than with EMFs (Laythe, 2015; Laythe et al. 2017), particularly in the methods and stark contrast between laboratory designs and field data. While studies examining EMF-relationships have been sporadically published for years, the methods and ontological assumptions have varied considerably and made contrasts among studies difficult to say the least.

Foremost among these issues are incorrect assumptions about EMF behavior in natural fieldwork settings. Laythe et al. (2017) have emphasized that EMFs are subject to rapidly declining strength as a function of distance, which essentially means an exponential decay rate (Thidé, 2004; Tipler, 1987). Thus, powerlines or electrical towers have been erroneously blamed for EMF findings when factually these structures can be relatively close and not affect the EMF of nearby environments. Similarly, artificially produced EMF has most of its magnetic force minimized as a function of using it to broadcast data (Thidé, 2004). Further, triangulation is rarely used with EMF in the field, which makes the detection of the precise source of EMF nearly impossible. Finally, the technology of EMF meters is receptive, and thus these have a limited range in which to detect EMF fields (that decay quickly). As a result, readings can sometimes be significantly altered by moving a meter two or three feet (Laythe et al. 2017).

These caveats are neither meant to claim that EMFs do not generally affect environmental systems, nor that Persinger effects do not potentially contribute to the environments that define haunted houses. Instead, we conclude only that means and manners of EMF data collection in the field have inhibited effective cross-study comparisons. For example, some evidence suggests that sleep disturbances, mood shifts, and increases in anxiety can coincide with changes in the activity of the geomagnetic field (for a review, see Persinger, 1987). Further studies suggest that people

with particularly sensitive temporal lobes, a condition sometimes generated by temporal lobe epilepsy or brain injuries, may be more susceptible to changes in GMF activity (e.g., Fuller Dobson, Wieser, & Moser, 1995; Persinger, 2001; Persinger & Koren, 2001, pp. 183-184).

Correlational research shows that geomagnetic activity may be stronger on days in which people report “bereavement hallucinations,” i.e., apparitions of people who recently died (Persinger, 1988; Persinger & Schaut, 1988). Extending to the field research of ghostly episodes, strong geomagnetic fields (around 200-MG or more above the average for the Earth’s GMF) have been documented at reputed haunts (for a review, see Roll & Persinger, 2001). However, we note that the above studies assume that within the mix of EMF magnitude (i.e. field strength) a persistent frequency exists that corresponds to the precise frequencies needed to produce a “sensed presence” or related hallucinatory-type effects.

Some experimental evidence also raises concern over the potential effects of EMF exposure on mental health (O’Connor, 1993; Paneth, 1993). For example, two studies have observed possible changes in brain wave activity on an electroencephalogram (EEG) following two-second exposure to EMFs as strong as 780-MG and higher (Bell, Marino, & Chesson, 1992; von Klitzing, 1991). Persinger, Richards, and Koren (1997) found changes in brain waves when lower strength magnetic fields (10-MG) were applied over several minutes, and these changes persisted a short time after the magnetic stimulation ceased. A review of experimental studies also suggests that brain chemistry and hormone levels may sometimes change in response to EMF exposure (Reiter, 1993). Some data also suggest that EMF exposure can also affect sleep (Sher, 2000), which might contribute to haunt experiences that occur during sleeping hours. Gangi and Johansson (2000) even proposed that EMF exposure can cause certain skin cells to release inflammatory substances that may cause itching and other skin sensations.

The EMFs in most buildings tend to average between 0.2- and 2-MG. Various field investigations of haunts have measured EMFs appreciably above this average (e.g., Persinger, Koren, & O'Connor, 2001; Roll, Maher, & Brown, 1996; Roll & Persinger, 2001, pp. 154-163; Wiseman, Watt, Greening, Stevens, & O'Keeffe, 2002). In the laboratory, Persinger, Tiller, and Koren (2000) studied the experiences of a man who had reported haunt phenomena in his home a few years before. When they applied a 10-MG EMF to his brain, the man reported experiencing brief "rushes of fear" and various odd sensations. This was followed by the man perceiving a visual image that seemed to resemble the apparition he remembered experiencing previously in his home. Changes in the man's brain wave activity were also measured via EEG in conjunction with his anomalous experience (for discussions of this and related work, see also Persinger, 2001; Persinger & Koren, 2001).

Laboratory research has also shown that anomalous perceptions and impressions can be artificially-induced in an observer by stimulating the brain with temporally complex, weak-intensity magnetic fields (e.g., Cook & Persinger, 2001; Persinger, 2001, 2003; Persinger et al., 2001; for reviews see Persinger & Koren, 2001a, 2001b). According to Persinger, anomalous perceptions are caused by temporally complex magnetic fields that induce partial micro-seizures (paroxysmal events) in temporal-lobe regions and the deep sub-cortical structures they house, i.e., the hippocampus/ amygdala (cf. Persinger & Koren, 2001b).

The essence of the account is that the induced micro-seizure can cascade through the neural landscape, with sufficient intensity, endowing internal thoughts, images, memories, feelings, and emotions with enough activation to intrude into, and embellish, currently ongoing perceptions (Persinger & Healey, 2002). A consequence of this biophysical interaction is that discrete changes in neurophysiology may vary in accordance with the temporal complexity of the magnetic field —

culminating in altered states, delusory attributions, and possibly sensory hallucinations. The clear and testable prediction is that such magnetic fields could be present at some reputed haunts and may well induce reports of sensed presences or other ghostly perceptions (e.g., Persinger et al., 2001; Persinger & Koren, 2001; Roll & Persinger, 2001).

However, the “Persinger effect” (i.e., EMF-induced hallucinations) as a comprehensive explanation for haunted houses is insufficient for several reasons. First, proponents of this theory do not consider the low probability that all haunts exist at environments that produce a *very specific and precise* patterned EMF wave that can affect temporal lobe functioning. In fact, Braithwaite (2008) noted that his haunt investigations have identified only two of around 50 sites with magnetic fields that were “temporally complex.” More than being merely *rare*, this incidence rate (~4%) might be described better as *coincidental*. Similarly, Laythe and Owen (2013) found highly varied EMF and GMF readings in a non-powered, electrical environment. This hints that “anomalous” EMF/GMF is not stable over time. Thus, it remains to be seen whether the waveforms measured and detailed in these studies have any implications for human experience, even in contextually and experientially rich settings.

Moreover, one notable study failed to replicate Persinger’s effect of magnetic fields on participants’ experiences but instead implicated the role of suggestion and prior belief (Granqvist et al., 2005). Persinger and Koren (2005) subsequently criticized Granqvist and colleagues by claiming that the fields used may not have been appropriate for eliciting a neurological response, possibly due to alterations in the temporal characteristics of the waveforms (for a reply, see Larsson, Fredrikson, Larhammar, & Granqvist, 2005). Persinger’s argument that a PC operating system can sufficiently distort magnetic fields to render them completely benign from a neurophysiological perspective seems to suggest a high degree of temporal specificity is required

to elicit the hypothesized effects. To support this, Persinger's earlier studies testing these hypotheses using a piece of apparatus called the "God Helmet" (where magnetic coils are strategically temporally placed) were partially replicated by a team whose production of 10mG magnetic fields in the helmet resulted in participants reporting various anomalous experiences including, significantly, sensing the presence of 'spiritual beings' (Tinoco & Ortiz, 2014).

Assuming *complexity* is a highly specific variable, Persinger's ideas presumably have limited applicability to most haunt reports since the specific complexity is unlikely to be commonly available. We further note that the evidence for magnetic fields as a significant variable in haunts is varied at best, since many studies have found no such effects. These include a number of *field investigations* (e.g. Maher, 2000; Wiseman et al., 2003b) and *laboratory experiments* (e.g. French, Hague, Bunton-Stasyshyn, & Davis, 2009). Williams (2015) also duly pointed out the lack of a historical relationship between reported haunts and manufactured EMFs. Cornell (2002) similarly noted that haunt accounts "...were widely reported long before the development and use of man-made electromagnetic utilities" (p. 388).

Still, several haunt investigations have documented EMF effects and found that the absolute *strength* or *intensity* of the magnetic fields at haunt sites might not be as important as the *fluctuation* of these fields over time. Particularly, these studies have strived to quantify the magnetic fields at reputed haunts and compare them to appropriate baselines (e.g., Braithwaite, 2004, 2008; Braithwaite, Perez-Aquino, & Townsend, 2004; Braithwaite & Townsend, 2005; Laythe & Owen 2013; Terhune et al., 2007; Wiseman et al., 2002, 2003b).

In at least two field investigations by William Roll (reported in Roll & Persinger, 2001), the strength of the magnetic fields was noted either to be gradually increasing or decreasing as one moved from one side of the haunted site to the other. During a fieldwork study of haunt reports at

historic Hampton Court Palace (England), Wiseman et al. (2002, 2003b) noted that changes in the magnetic fields in areas of the palace associated with anomalous experiences significantly differed from the EMF changes in “control” or comparison areas associated with no anomalous experiences. They also found a correlation between the variance of the field and number of unusual experiences reported.

Braithwaite and colleagues examined a specific bedroom at the historic Muncaster Castle (England) on multiple occasions (Braithwaite, 2004; Braithwaite et al., 2004). Witnesses sleeping in the room reported hearing voices at night that resembled children crying. Braithwaite and colleagues took measurements in the area around the pillow of the bed and later compared them to control measurements taken towards the center of the room where the mysterious voices apparently originated. Notable changes in magnetic field strength were observed over this very short distance (~ a few meters). Similarly, Terhune et al. (2007) found suggestive differences when statistically comparing the magnetic field changes in areas where haunt phenomena were reported to control areas with no reported phenomena.

Other researchers have suggested that the stimulatory potential of magnetic fields might be increased if they exist within certain “spooky” experiential contexts and associated with contextually-loaded visual or semantic stimuli within the setting (i.e., gothic architecture or contexts provided by historic buildings: Braithwaite, 2008; Braithwaite et al., 2005; Braithwaite & Townsend, 2005; Houran, 2002; Lange & Houran, 1997a; Ralphs, 2014). One possibility is that the magnetic fields and contextual variables work together to manipulate non-specific arousal and expectation in certain susceptible observers.

Recent research further complicates the “EMF-haunted house” relationship. Earlier work by Wilson et al. (2010) found changes in EMF fields during a single séance session where light

anomalies and ostensible physical “rappings” occurred. However, more detailed analysis of EMF, time, and haunt phenomena appear to show real-time and significant associations between EMFs and “objective” or physical-oriented anomalies (Laythe & Owen, 2013; Laythe & Houran, 2019).

In both of the aforementioned studies, anomalous phenomena on audio or video such as apparitions, vetted EVP, and PK in field laboratory environments were shown to correlate with significant “micro” expansion or suppression of the area’s EMF field during the time period of the documented anomalous event. It is also the case that hourly correlations of EMF/GMF meters in the Laythe and Owen (2013) study wildly varied on an hourly basis in a location approximately a half-mile from electrical sources. Further investigation by Laythe et al. (2017) in a laboratory séance setting found significant variability of EMF and GMF across sessions, and EMF-spikes were significantly associated with participants’ anomalous experiences. This indicates that *micro-expansion* or *micro-contraction* of EMF is also associated with reported “subjective” experiences in haunt-related contexts.

Laythe’s three studies noted above appear to challenge conventional physics-oriented explanations for his observed EMF effects. His work further undermines the hallucinatory/ EMF model of anomalous phenomena as the sole explanation. Both Laythe and Owen (2013) and Laythe and Houran (2019) recorded “objective” anomalies (tangible and measurable) in association with significant EMF fluctuations. Given that EMF manifests as either a *vector* (a focused wave with direction), or a *general field* with a source of origin, neither study could account for any source of EMF that could theoretically create localized variability in the EMF field. Although these “micro EMF-expansion and -suppression” effects appear provocative and have now been conceptually replicated three times in different environments, we deem them tentative pending independent validation.

DISCUSSION

Researchers have pinpointed several conventional factors that can theoretically impact, though perhaps subtly or unwittingly, the psychological experience of natural and built environments. However, the literature we consulted offered neither abundantly clear, nor persuasive evidence for most of these ostensible unconscious- or conscious-stimulants as a robust model for “haunted houses.” Specifically, it appears that the hypothetical influence of environmental variables touted by some authors (e.g., Alexander & Muzzillo, 2010/2014; Houran, 1997; McAndrew, 2015; Tandy & Lawrence, 1998; Vinokur, 2005, 2016) does not consistently match their observed influence.

We conclude therefore that an exclusively or chiefly environmental model — i.e., relying on discrete embedded cues, air quality, temperature levels, infrasound, lighting-levels, or electromagnetic fields — is presently ineffective as a general explanation for what imprints certain locations or settings with a haunted persona (or “creepiness”) or serves as the predominant source of anomalous experiences in these contexts. That said, it is highly questionable that evolutionary-environmental perspectives on ghostly episodes have been adequately explored or tested, despite the long legacy of fieldwork studies and instrumentation in haunt-related research (for overviews, see e.g., Bebergal, 2018; Braithwaite, 2006; Houran, 2017; Houran & Lange, 1998; Osis, 1982; Parsons & O’Keeffe, 2008; Radford, 2018).

Moreover, we continue to anticipate slow advancements in understanding “haunted houses” given their taboo standing within many academic circles and publications. A disreputable image is sparked by paranormal or pseudo-scientific connotations and reinforced by dramatized “investigations” that are dominated by amateur enthusiasts who tend neither to be professionally trained nor scientifically oriented (for discussions, see Eaton, 2015; Hill, 2017; Hill et al., 2019;

Potts, 2004). This situation is unfortunate, because empirical study in this domain transcends psychological research and spiritual practices to be potentially instructive for exploring or refining important issues across the biomedical and social sciences. These include *sensory thresholds* and *perceptual biases* (van Elk, 2015), *sick building syndrome* (Shoemaker & House, 2006), *mass (contagious) psychogenic illness* (Chen, Yen, Lin, & Yang, 2003), *embodied-cognition* (Goldhagen, 2017), *place identity and attachment* (Donohoe, 2014; Seamon, 2014), *nature of “creepiness”* (McAndrew, 2015; McAndrew & Koehnke, 2016), *exceptional architectural experiences* (Bermudez, 2009; Bermudez & Ro, 2018), and the psychology of *sacred or enchanted spaces* (e.g., Holloway, 2010; Lidov, 2006).

Accordingly, scientific efforts to describe haunted houses and related phenomena in environmental terms should address several issues. First, our literature review revealed a dearth of detailed and quality research in this area. Future studies must therefore strive to measure discrete physical factors more consistently, comprehensively, and precisely. Here we propose that fieldwork should include experts in architectural design, engineering, environmental sciences, and physics. Such specialists in “environmental and architectural phenomenology” could be invaluable in developing or implementing new research designs. Moreover, investigations must consider individual differences in the attentional or perceptual thresholds of experiencers versus non-experiencers in haunt-type cases (e.g., Jawer, 2006; Lange & Houran, 2001a, 2001b; Laythe et al., 2018; Parra, 2018; Romer, 2013; Ventola et al., 2019). It could be that the types of physical variables reviewed here are germane to a subset of witness reports grounded in hypervigilance or heightened sensitivities to these conventional stimuli.

“Gestalt influences” are additional confounds whose roles in this domain have yet to be understood. These are ambient, structural, or contextual variables that mediate or define a person’s

rational or emotional “impression formation” of specific spaces and settings. Jawer et al. (2020) discussed important examples including: (i) affordance, (ii) atmosphere, (iii) ambiguity and threat anticipatory processes, (iv) immersion and presence, (v) legibility, and (vi) percipient memory and associations [e.g., transgenerational, transpersonal, and archetypal memories (Caputo, 2017; Jung, 1979) that can be involved in apparitional/spiritual phenomena and are specifically encoded or contextually re-encoded through haunted, enchanted, and sacred places].

These effects might involve, but are not limited to, the discrete physical factors proposed as stimulants of anomalous experiences. Gestalt influences instead speak to the larger concept of systems theory, i.e., *environment-person bidirectional or enactive processes* (e.g., Goldhagen, 2017; Jelić, Tieri, De Matteis, Babiloni, & Vecchiato, 2016). This holistic view identifies psychosocial elements as important contributors to the onset or structure of personal experiences, which agrees with conclusions from our social-psychological reviews of ghost narratives (Drinkwater et al., 2019; Hill et al., 2018, 2019; Houran et al., 2019).

To be sure, considerable evidence implicates attitudinal, normative, and situational influences in the phenomenology of witness accounts (e.g., Dagnall et al., 2015; Drinkwater, Dagnall, & Bate, 2013; Drinkwater, Dagnall, Grogan, & Riley, 2017; French et al., 2009; Houran, 2002; Houran et al., 2019b; Houran et al., 2002; Langston & Hubbard, 2019; Laythe et al., 2018; Pharino, Pearce, & Pryce, 2018; Wiseman et al., 2002, 2003b). Such findings underscore that physical variables might not be the primary culprits in most spontaneous cases. For instance, Aluet and Vidal (2018) stated that “Sacred spaces are complex realities whose internal dynamics must be studied from a multidisciplinary and transversal perspective that draws on anthropology, sociology, theology, philosophy, tourism, culture and more” (p. 255). Likewise, “haunted houses” could be variants of sacred spaces (Jawer et al., 2020) and thus may have eluded definitive

explanation for millennia due to roots in complex interactions (or “dynamical systems”: e.g., Lange & Houran, 2000, 2001b) among certain physical variables, sociocultural influences, situational context, and interpersonal dynamics — all of which shape the character of spaces and settings, as well as define how experiencers are ultimately situated inside them.

In closing, we would be remiss not to mention an environmental model for haunts taken to the extreme. The actual solution might be a fusion of orthodox and esoteric perspectives. Specifically, increased attention has been paid to the hypothesis that human consciousness itself, and indeed all that we experience as reality, derives from a sophisticated hologram or computer program — as depicted in the sci-fi classic film franchise, *The Matrix*. Academics refer to this as the *simulation hypothesis*, and if valid, it implies quite literally that “ghosts are in the machine.” That is, the anomalies that characterize haunt-type episodes might represent glitches in the software or hardware that produces or operates the simulation.

The basic idea that ghostly phenomena can be interpreted in informational terms parallels some current thinking in parapsychology (e.g., Radin, 2018). More pointedly, Merali (2013) outlined intriguing empirical and conceptual arguments consistent with the simulation hypothesis, and Wikipedia likewise has an informative entry on the topic. This intriguing notion, like that of ghosts and supernatural agencies, might prove incorrect. But asking these types of questions underscores the fundamental need that human beings apparently have to explore and hopefully understand all facets of their holistic environments. We sympathize with “paranormal” witnesses in this regard, because academia does not yet have a convincing, comprehensive, and *scientific* explanation for “haunted houses” — and perhaps it never will.

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In review