

Electronic Voice Phenomena Project Phase 1

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Introduction

I have been studying the EVP (Electronic Voice Phenomenon) area of paranormal research since 1976. Over the course of these many years I have compiled and analyzed an incredible amount of evidence, both audio and environmental in relationship to the individual events. I have come to some findings that I believe explains exactly what an EVP is.

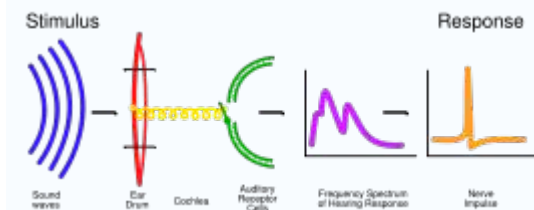
Rarely during an investigation are voices actually “heard” by the human ear. Although it happens on occasion, for the most part EVPs are recorded on a medium, and discovered during the playback sequence of the device used, be it a tape recorder, digital recorder, video cam or VCR/DVR set up. The question that has haunted me for years is “why”? To explain this you have to understand how sound is recorded in the first place. First, let me define a few things.

Definitions

Audio engineering is a part of audio science dealing with the recording and reproduction of sound through mechanical and electronic means. The field of audio engineering draws on many disciplines, including electrical engineering, acoustics, psychoacoustics, and music. Unlike acoustical engineering, audio engineering generally does not deal with noise control or acoustical design. Much of audio engineering is also used in broadcast engineering.

Sound is a disturbance of mechanical energy that propagates through matter as a wave. Sound is characterized by the properties of sound waves which are frequency, wavelength, period, amplitude and velocity or speed.

Perception of sound



A schematic representation of hearing. (Blue: sound waves. Red: eardrum. Yellow: cochlea. Green: auditory receptor cells. Purple: frequency spectrum of hearing response. Orange: nerve impulse.)

Sound is perceived through the sense of hearing. Humans and many animals use their ears to hear sound, but loud sounds and low frequency sounds can be perceived by other parts of the body through the sense of touch. Sounds are used in several ways, most notably for communication through speech or, for example, music. Sound can also be used to acquire information about properties of the surrounding environment such as spatial characteristics and presence of other animals or objects. For example, bats use echolocation, ships and submarines use sonar, and humans can determine spatial information by the way in which they perceive sounds.

The range of frequencies that humans can hear is approximately between 20 Hz and 20,000 Hz. This range is by definition the audible spectrum, but some people (particularly women) can hear above 20,000 Hz. This range varies by individual and generally shrinks with age, mostly in the upper part of the spectrum. The ear is most sensitive to frequencies around 3,500 Hz. Sound above 20,000 Hz is known as ultrasound; sound below 20 Hz as infrasound.

The amplitude of a sound wave is specified in terms of its pressure. The human ear can detect sounds with a very wide range of amplitudes and a logarithmic decibel amplitude scale is used. The quietest sounds that humans can hear have an amplitude of approximately 20 μPa (micropascals) or a sound pressure level (SPL) of 0 dB re 20 μPa (often incorrectly abbreviated as 0 dB SPL). Prolonged

exposure to a sound pressure level exceeding 85 dB can permanently damage the ear, sometimes resulting in tinnitus and hearing impairment. Sound levels in excess of 130 dB are considered above of what the human ear can withstand and may result in serious pain and permanent damage. At very high amplitudes, sound waves exhibit non-linear effects including shock.

Speed of sound

The speed at which sound travels depends on the medium through which the sound waves pass, and is often quoted as a fundamental property of the material. In general, the speed of sound is proportional to the square root of the ratio of the stiffness of the medium and its density. Those physical properties and the speed of sound change with ambient conditions. For example, the speed of sound in air and other gases depends on temperature. In air, the speed of sound is approximately 345 ms^{-1} , in water 1500 ms^{-1} and in a bar of steel 5000 ms^{-1} .

Sound pressure

Sound pressure is the pressure deviation from the local ambient pressure caused by a **sound** wave. Sound pressure can be measured using a microphone in air and a hydrophone in water. The SI unit for sound pressure is the pascal (symbol: Pa). The instantaneous sound pressure is the deviation from the local ambient pressure caused by a sound wave at a given location and given instant in time. The effective sound pressure is the root mean square of the instantaneous sound pressure over a given interval of time. In a sound wave, the complementary variable to sound pressure is the acoustic particle velocity. For small amplitudes, sound pressure and particle velocity are linearly related and their ratio is the acoustic impedance. The acoustic impedance depends on both the characteristics of the wave and the medium. The local instantaneous sound intensity is the product of the sound pressure and the acoustic particle velocity and is, therefore, a vector quantity.

Sound pressure level

As the human ear can detect sounds with a very wide range of amplitudes, sound pressure is often measured as a level on a logarithmic decibel scale.

The **sound pressure level** (SPL) or L_p is defined as

$$L_p = 10 \log_{10} \left(\frac{p^2}{p_0^2} \right) = 20 \log_{10} \left(\frac{p}{p_0} \right) \text{ dB}$$

where p is the root-mean-square sound pressure and p_0 is a reference sound pressure. (When using sound pressure levels, it is important to always quote the reference sound pressure used.) Commonly used reference sound pressures, defined in the standard ANSI S1.1-1994, are 20 μPa in air and 1 μPa in water.

Since the human ear does not have a flat spectral response, sound pressure levels are often frequency weighted so that the measured level will match perceived sound level. The International Electrotechnical Commission (IEC) has defined several weighting schemes. A-weighting attempts to match the response of the human ear to noise and A-weighted sound pressure levels are labeled dBA. C-weighting is used to measure peak sound levels.

Examples of sound pressure and sound pressure levels

Source of sound	sound pressure	sound pressure level
	pascal	dB re 20 μPa
Threshold of pain	100	134
Hearing damage during short term effect	20	approx. 120
Jet, 100 m distant	6 - 200	110 - 140
Jack hammer, 1 m distant / night club	2	approx. 100
Hearing damage during long-term effect	6×10^{-1}	approx. 90
Major road, 10 m distant	2×10^{-1} - 6×10^{-1}	80 - 90

Passenger car, 10 m distant	$2 \times 10^{-2} - 2 \times 10^{-1}$	60 - 80
TV set at home level, 1 m distant	2×10^{-2}	ca. 60
Normal talking, 1 m distant	$2 \times 10^{-3} - 2 \times 10^{-2}$	40 - 60
Very calm room	$2 \times 10^{-4} - 6 \times 10^{-4}$	20 - 30
Leaves noise, calm breathing	6×10^{-5}	10
Auditory threshold at 2 kHz	2×10^{-5}	0

References

Beranek, Leo L, "Acoustics" (1993) Acoustical Society of America.

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The Foundation

Magnetic storage is a term from engineering referring to the storage of data on a magnetised medium. Magnetic storage was first suggested by Obeline Smith in 1888. The first magnetic recorder was invented by Valdemar Poulsen in 1895.

The read/write heads in magnetic storage record data in the form of magnetized spots on iron oxide coatings.

Media types that exploit magnetic storage include hard disk and floppy disk drives, zip drives and various tape drives, video cassettes and audio cassettes, magnetic core memory, thin film memory and drum memory.

A new type of magnetic storage, called MRAM, is being produced that stores data in terms of polarity rather than electric charge. The advantage to this is that it will require far less electricity and will still remain intact in case of a crash.

Remember, sound recording is magnetic in nature.

Microphone

A **microphone**, sometimes referred to as a **mike** or **mic** (pronounced "mike"), is an acoustic to electric transducer that converts sound into an electrical signal. Microphones are used in many applications such as telephones, tape recorders, hearing aids, motion picture production, live and recorded audio engineering, in radio and television broadcasting and in computers for recording voice, VoIP and numerous other computer applications.

Principle of operation

All microphones capture sound waves with a thin, flexible diaphragm (or ribbon in the case of ribbon microphones). The vibrations of this element are then converted by various methods into an electrical signal that is an analog of the original sound. Most microphones in use today use electromagnetic generation (dynamic microphones), capacitance change (condenser microphones) or piezoelectric generation to produce the signal from mechanical vibration.

Microphone Types

Capacitor or condenser microphones

In a capacitor microphone, also known as a condenser microphone, the diaphragm acts as one plate of a capacitor, and the vibrations produce changes in the distance between the plates. Since the plates are biased with a fixed charge (Q), the voltage maintained across the capacitor plates changes with the vibrations in the air, according to the capacitance equation:

$$Q = C \cdot V$$

where Q = charge in coulombs, C = capacitance in farads and V = potential difference in volts. The capacitance of the plates is inversely proportional to the distance between them for a parallel-plate capacitor.

$$C \propto \frac{A}{d}$$

Capacitor microphones can be expensive and require a power supply, commonly provided from mic inputs as phantom power, but give a high-quality sound signal and are now the preferred choice in laboratory and studio recording applications.

Electret capacitor microphones

An electret microphone is a relatively new type of condenser microphone invented at Bell Laboratories in 1962 by Gerhard Sessler and Jim West, and often simply called an **electret** microphone. An electret is a dielectric material that has been permanently electrically charged or *polarized*. The name comes from *electrostatic* and *magnet*; a static charge is embedded in an electret by alignment of the static charges in the material, much the way a magnet is made by aligning the magnetic domains in a piece of iron. They are used in many applications, from high-quality recording and lavalier use to built-in microphones in small sound recording devices and telephones. Though electret mikes were once considered low-cost and low quality, the best ones can now rival capacitor mikes in every respect (apart from low noise) and can even have the long-term stability and ultra-flat response needed for a measuring microphone. Unlike other condenser microphones, they require no polarising voltage, but normally contain an integrated preamplifier which does require power (often incorrectly called polarizing power or bias). This preamp is frequently phantom powered in sound reinforcement and studio applications. While few electret microphones rival the best DC-polarized units in terms of noise level, this is not due to any inherent limitation of the electret. Rather, mass production techniques needed to produce electrets cheaply don't lend themselves to the precision needed to produce the highest quality microphones.

Dynamic microphones

In a dynamic microphone a small movable induction coil, positioned in the magnetic field of a permanent magnet, is attached to the diaphragm. When sound enters through the windscreen of the microphone, the sound wave vibrations move the diaphragm. When the diaphragm vibrates, the coil moves in the magnetic field, producing a varying current in the coil through electromagnetic induction. The principle is exactly the same as in a loudspeaker, only reversed. Dynamic microphones are robust, relatively inexpensive, and resistant to moisture, and for this reason they are widely used on-stage by singers. They tend to have a poor low-frequency response, which is advantageous for reducing handling noise as a vocal mic, but tends to exclude them from other uses.

Ribbon microphones

In ribbon microphones a thin, usually corrugated metal ribbon is suspended in a magnetic field. The ribbon is electrically connected to the microphone's output, and its vibration within the magnetic field generates the electrical signal. Basic ribbon microphones detect sound in a bidirectional (also called figure-eight) pattern because the ribbon, which is open to sound both front and back, responds to the pressure gradient rather than the sound pressure. Though the symmetrical front and rear pickup can be a nuisance in normal stereo recording, the high side rejection can be used to advantage by positioning a ribbon mic horizontally, for example above cymbals, so that the rear lobe picks up only sound from the ceiling. Other directional patterns are produced by enclosing one side of the ribbon in an acoustic trap or baffle, allowing sound to reach only one side. Ribbon mics give very high quality sound reproduction, and were once valued for this reason, but a good low-frequency response can be obtained only if the ribbon is suspended very loosely, and this makes them fragile. Protective wind screens can reduce the danger of damaging the ribbon, but will somewhat reduce the bass response at large miking distances.

Ribbon microphones don't require phantom power; in fact, this voltage can damage these microphones.

Carbon microphones

A carbon microphone, formerly used in telephone handsets, is a capsule containing carbon granules pressed between two metal plates. A voltage is applied across the metal plates, causing a small current to flow through the carbon. One of the plates, the diaphragm, vibrates in sympathy with incident sound waves, applying a varying pressure to the carbon. The changing pressure deforms the granules, causing the contact area between each pair of adjacent granules to change, and this causes the electrical resistance of the mass of granules to change. The changes in resistance cause a corresponding change in the voltage across the two plates, and hence in the current flowing through the microphone, producing the electrical signal. Carbon microphones were once commonly used in telephones; they have extremely low-quality sound reproduction and a very limited frequency response range, but are very robust devices. Unlike other microphone types, the carbon microphone can also be used as a type of amplifier, using a small amount of sound energy to produce a larger amount of electrical energy. Carbon microphones found use as early telephone repeaters, making long distance phone calls possible in the era before vacuum tubes. These repeaters worked by mechanically coupling a magnetic telephone receiver to a carbon microphone: the faint signal from the receiver was transferred to the microphone, with a resulting stronger electrical signal to send down the line.

Piezo microphones

A piezo (pronounced "*pee-ay-zo*" or "*pie-ee-zo*") microphone uses the phenomenon of piezoelectricity—the ability of some materials to produce a voltage when subjected to pressure—to convert vibrations into an electrical signal. Piezo transducers are often used as **contact microphones** to amplify acoustic instruments for live performance, or to record sounds in unusual environments (underwater, for instance).

An example of this is Rochelle salt (potassium sodium tartrate), which is a piezoelectric crystal that works as a transducer both ways; it is also commonly used as a slimline loudspeaker component.

Laser microphones

A laser microphone is an exotic application of laser technology. It consists of a laser beam that must be reflected off a glass window or another rigid surface that vibrates in sympathy with nearby sounds. This device essentially turns any vibrating surface near the source of sound into a microphone. It does this by measuring the distance between itself and the surface extremely accurately; the tiny fluctuations in this distance become the electrical signal of the sounds picked up. Laser microphones are new, very rare and expensive, and are most commonly portrayed in the movies as spying devices.

Speakers as microphones

A loudspeaker is the exact opposite of a microphone, since it's a transducer that turns an electrical signal into sound waves. However, because a conventional speaker is constructed much like a dynamic microphone (with a diaphragm, coil and magnet), speakers can actually work "in reverse" as microphones. The result, though, is a microphone with poor quality, limited frequency response (particularly at the high end), and poor sensitivity.

In practical use, speakers are sometimes used as microphones in such applications as intercoms or walkie-talkies, where high quality and sensitivity are not needed. However, there is at least one other novel application of this principle; using a medium-size woofer placed closely in front of a "kick" (bass drum) in a drum set to act as a microphone. This has been commercialized with the Yamaha "Subkick".

Operational Microphone Data

After compiling the data from hundreds of recordings and analyzing all the data, the following findings have become evident:

Microphone Selection

Capacitor or Condenser – I have never captured an EVP using a capacitor microphone. Capacitor microphones respond to changes in capacitance. I would like to continue this research if I ever capture an EVP, with capacitance field readings during the event. So far I have not been able to develop a device to measure any significant capacitance fluctuations during a paranormal event.

Electret – Many EVPs have been captured by both the community at large as well as verified by my own research. Electret microphones respond not only to capacitance, and vibrations, but magnetic fields as well.

Dynamic – By far the most common method historically of capturing EVPs. These microphones respond to vibration as well as magnetic fields.

Ribbon – I have captured several EVPs while using ribbon microphones. However, due to their delicate nature, I do not recommend them for field use. Ribbon microphones respond to sound pressure variations as well as magnetic field fluctuations.

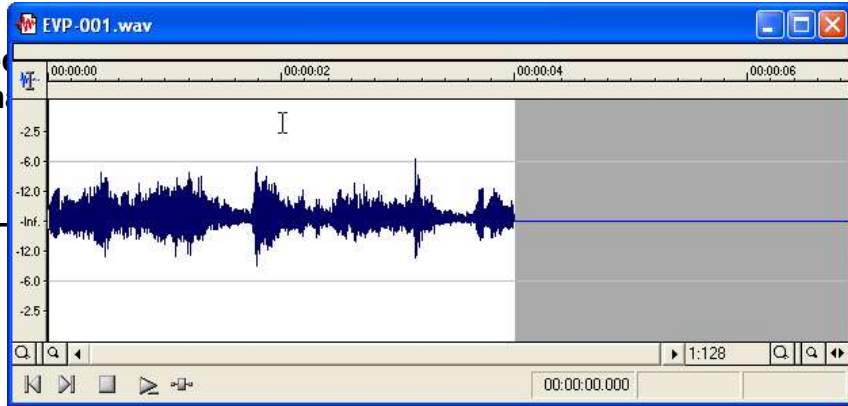
Carbon – I have never used a carbon microphone in field study, but there are reports from the past of “ghost voices” being heard over the telephone. While they are not magnetic by nature, they do respond somewhat to magnetic field fluctuations, if the fluctuations are fairly intense in nature.

Piezo – I have never been able to capture an EVP with a piezo microphone. They respond to vibrations, but because of their crystal nature, it is possible for them to respond to magnetic fluctuation, if they are extraordinarily strong.

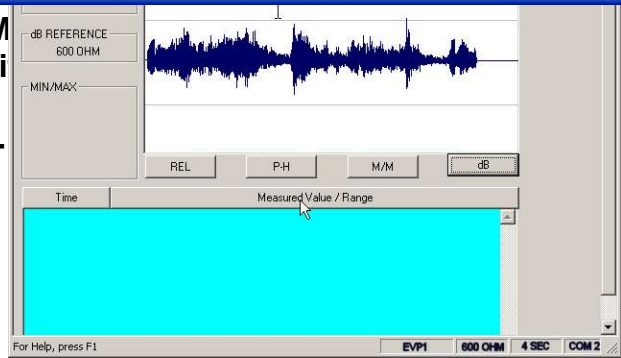
Laser – I have not been able to test a laser microphone in this application.

Investigation Data

- Audio Wave Form as recorded by Voice Recorder and AKG dynamic microphone
- Audio level Peaks at -6dB

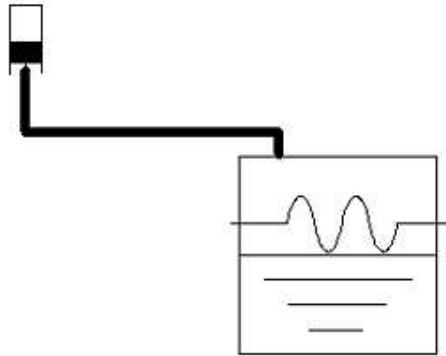


- Magnetic field measured with MagCheck 95 Probe coupled with a 600 OHM resistor
- Peaks @ -32dB
- Wave Form is an exact match – software





Magnetic
Sciences
International
MAG CHECK
95
Sensor



Velleman HPS 10
Personal Scope

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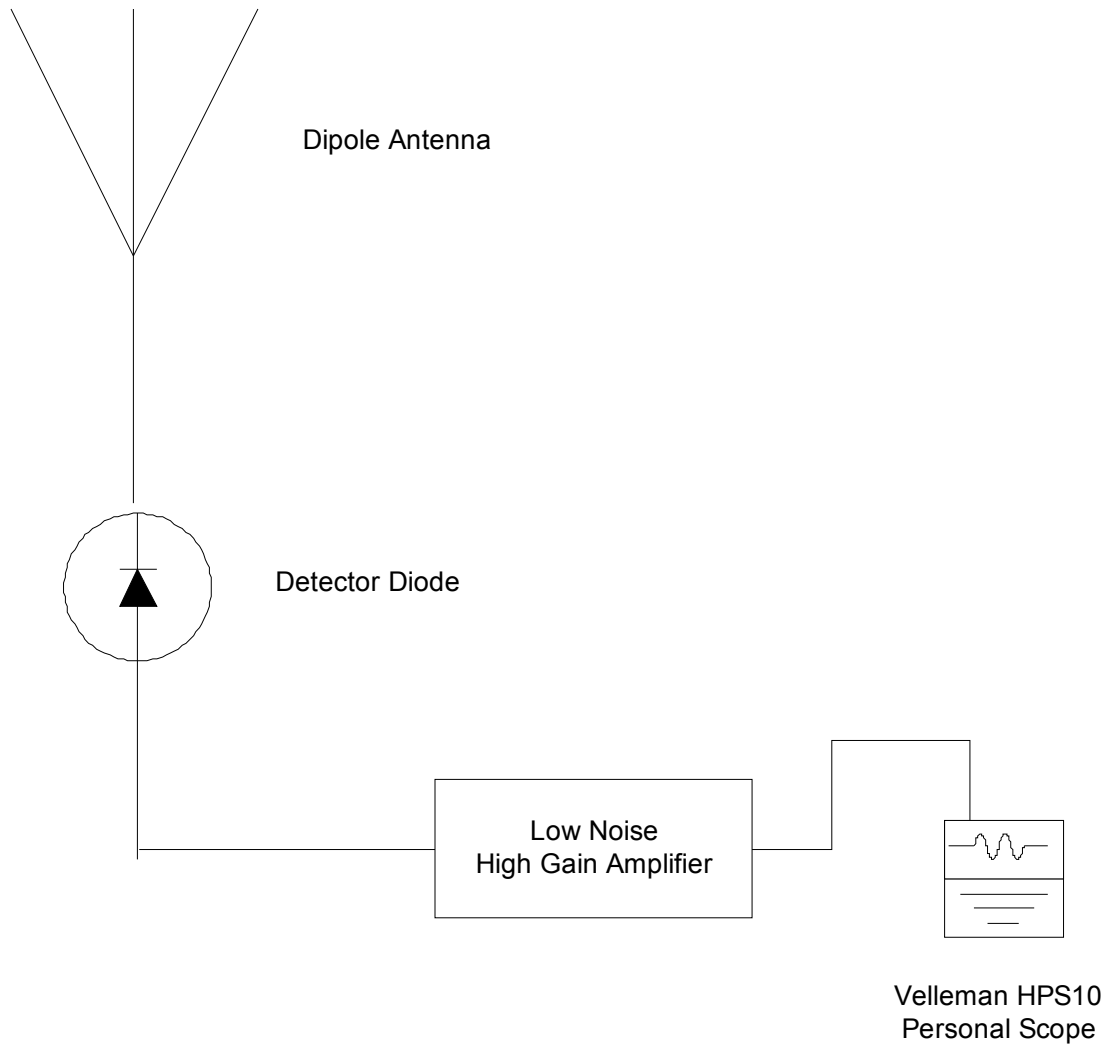
Conclusions

The human ear responds to mechanical vibrations. This evidence clearly demonstrates that some Electronic Voice Phenomena are not mechanical in nature as a rule. There are some exceptions to this, such as a manifestation of an apparition or an event that has sufficient substance and mass to create a mechanical vibration due to the sufficient mass vibrating in the audio spectrum. However, when this occurs, the magnetic field is also present. I have witnessed this on two separate investigations to date. Generally speaking, unless the manifestation emits an extraordinary amount of energy, EVPs appear to be magnetic in nature. This explains why the human ear usually can't detect them, but explains why the various recording devices pick them up.

The common denominator in all EVP recordings is a magnetic or electromagnetic sensitive device is employed to detect the phenomena, as well as it being transcribed on a storage medium that is magnetic or electromagnetic in nature. A correlation of this evidence is provided by a measured increase in field magnetism in the area where the EVP is recorded, hence an increase in background magnetic fields during an EVP and other paranormal events. I can only conclude from this evidence that an EVP is not mechanical, but magnetic in nature.

Future Research

The next phase of the research will be to correlate any relationship between the measured magnetic phenomena, and electrical energy in the event horizon. To do this, a new detection device had to be invented. I have completed this device and put it through a series of function tests to prove the device is reliable at measuring electrical energy in the audio spectrum. The schematic for this device and the configuration with a personal oscilloscope as the measuring medium are shown below.



Audio Electrical Field Detector

Afterword

We are all in this field of research because we seek answers to the unknown. The task we face in accomplishing this is to determine whether a particular phenomena is unknown, or unknowable with current technology. Keeping this in mind, additional research must be pursued in the area of test and measurement in order to map and possibly help identify the composition of the aforementioned phenomena. If we do not proceed in this fashion, the field will stagnate.

While I have not been able to locate the source of EVP emissions, I understand what the phenomenon really is. This understanding and the pursuit of it, brings us closer to discovering its nature, and the source.

Post Script

After employing the Audio Electrical Field Detector I designed above, I was unable to correlate the presence of audio electrical fields. This eliminates several natural and explainable causes for EVPs. Additionally I have discovered that EVPs occur when the Air conductivity is at an elevated level. What I don't know is whether the increased conductivity of the air facilitates the generation of EVPs, or whether it is a byproduct of it.

I am currently designing a sensor based on a microwave dish and low noise amplifier to eliminate Microwave harmonic frequencies as a possible source for EVP. More on this in part 2 of this research.