



WHY SOME PEOPLE SEE, HEAR, OR FEEL “GHOSTS”

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Think about your favorite scary story. Chances are that story involves seeing or hearing something in a dark, scary place. These stories are so good at scaring us because many people have seen or heard strange things in the dark, especially if they were already scared in the first place. What is it about dark and scary places that can make us think we have seen, heard, or felt a spooky presence? There are many scientific explanations for these fears. Scientists have discovered that what we think are ghosts might actually just be our brains playing tricks on us! This is perfectly normal and results from small errors in the way our brains interpret information from the environment when we are scared. In this article, we will discuss how our brains process fear and why we might see, hear, or even feel a ghostly presence that is not really there!

WAS IT A GHOST?

Imagine this: in a town called Athens stood a large, abandoned old house surrounded by weeds and dead trees. Even on sunny days, the

house always seemed to be in the shadows. Everyone in the town was afraid of it, so it sat, empty and rotting, for years. One day, a high school student moved to Athens. The student was curious and asked the townspeople about the old, abandoned house. The people told the student that the house was haunted by its first owner, who met a tragic end, and they described the ghost that lurked there—a thin, old woman with a long, tattered white nightgown who would haunt anyone foolish enough to spend the night. Fascinated by this story, the student went to the house to stay the night. At first, the night seemed just like any other. Eventually, he fell asleep, tossing and turning with horrible nightmares. The sound of a door slamming woke him, and he found himself covered in sweat and struggling to see in the dark. As his eyes adjusted, he saw something in the room. From the open closet door, the thin face of an old woman was smiling at him.

Was that a ghost? Science says probably not. Researchers have found that errors in **perception** might be to blame. That is, our brains can misinterpret information! Those errors are even more likely when people are in situations where they might expect to come across a ghost or are already scared. Fear is a powerful emotion and can alter what we see, hear, or even feel.

HOW DOES FEAR CHANGE WHAT WE SEE AND HEAR?

When we are afraid, we feel negative emotions caused by the belief that something dangerous is nearby. If you have ever woken up in the middle of the night surrounded by darkness and shadows, for example, you probably know this type of fear. This is a natural reaction, because humans tend to be afraid of dark spaces where it is hard to see what is happening around us. This comes from our prehistoric days. In the dark, humans would have been more likely to be attacked by predators because they could not see them. Fear protects us from harm by making us more **vigilant** (on alert) about our surroundings.

If fear protects us by making us more aware of our surroundings, then it must make us better at figuring out what is going on around us, right? Unfortunately, it is not quite so easy. Fear interrupts important processes in the brain, and this can lead to irrational thinking patterns. Irrational thinking causes us to be more likely to jump to conclusions about our surroundings. When we are afraid, a few important brain areas become more active, including the prefrontal cortex, the amygdala, the hypothalamus, and the periaqueductal gray (Figure 1).

When you wake up in the middle of the night, the shadows can play tricks on your eyes. In this situation, your prefrontal cortex is interpreting your surroundings. It is dark and you cannot see very well, so your brain prepares you for the chance that one of those shadows could be something dangerous. Your amygdala receives this

PERCEPTION

Interpreting information from our primary senses (hearing, sight, touch, smell, taste). For example, we can taste something sweet, but the ability to identify it as chocolate is a perception.

VIGILANT

The state of being on alert to avoid danger, similar to feeling anxious about a test or being on edge about going to the doctor's office.

Figure 1

(A) The prefrontal cortex, an area at the front of the brain responsible for giving meaning to events. (B) The amygdala, two almond-shaped areas inside the brain that put you on guard. (C) The hypothalamus, a small area in the middle of the brain that controls panic responses as well as energy and stress levels. (D) The periaqueductal gray, an area inside the brain that controls how we respond to fear (Photograph credit: BrainFacts.org).

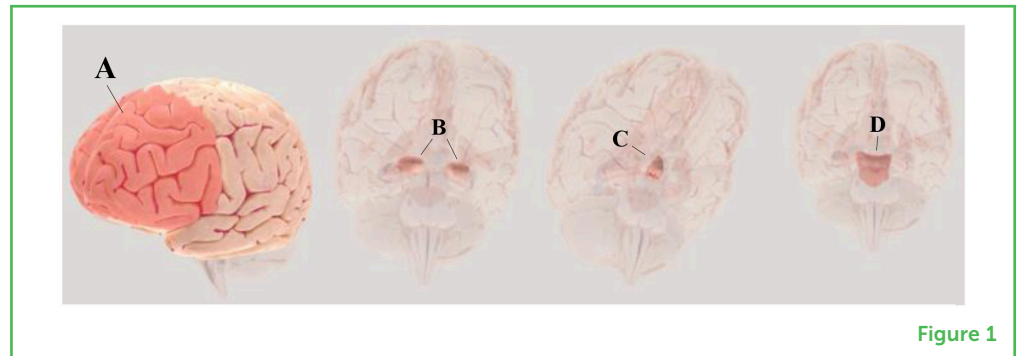


Figure 1

information from your prefrontal cortex and puts you on guard. Your hypothalamus then causes you to feel panicked and scared. Finally, imagine hearing a noise during this time. It is probably just the house settling or a neighbor going out, but your thoughts turn to ghosts and monsters. At this point, you might hide under the covers or jump out of bed to turn on the light. Your ability to act in this situation is thanks to your periaqueductal gray's flight response, which helps you get away from danger as fast as possible. It is easy to give in to fear. If you feel afraid in a dark house, it is just your brain processing the sights and sounds as a worst-case scenario. Although that sounds like a bad thing, that fear is a natural response that helped our ancestors stay alive!

WHY WOULD SOMEBODY SEE OR HEAR A GHOST?

Your brain is constantly taking in information from the world around you. Not all signals are important, though, so your brain filters out extra sensations and interprets just the important ones. For example, your brain is probably filtering out the feel of your clothes against your skin right now, allowing you to pay attention to what you are reading.

Usually, the brain is pretty accurate at selecting the important information and then giving it meaning. Sometimes, however, the brain makes mistakes about what information should be given meaning, and how. This happens when the brain hears or sees patterns that are not really there. A good example of seeing a false pattern is looking at the clouds and thinking that they look like something else, like a face. This is called **pareidolia** (Figure 2).

PAREIDOLIA

Finding meaning where none really exists. For example, seeing faces in clouds or on fire hydrants.

In a recent study, researchers asked participants questions about their experiences with ghosts [1]. Then, they were shown pictures of noisy patterns, which are patterns that look like television static (Figure 3). Some of these images had faces in them that were easy to see and some had faces that were difficult to see. Some had no faces. The participants who said they had more ghostly experiences were more likely to spot the faces in the images that had them. They were also more likely to see faces in images that did not even have faces! In other words, the beliefs that you have about the world around you

Figure 2

Have you ever looked up at the clouds and seen fun shapes, like faces or animals? There is a name for seeing these sorts of meaningful patterns where they do not really exist: pareidolia. People have seen animals in the clouds, faces on cars, and even landscapes burnt into toast. What do you see here?



Figure 2

Figure 3

Noise patterns are made of many tiny black-and-white dots, lines, or squares. Here, we see a television screen displaying static, which is a type of noise pattern.



Figure 3

can change how you see things. Many people who see ghosts are often in dark places where they might think they will see something scary. They cannot see well, so their brains have to make up for the lack of detail by filling in the blanks. This makes them more likely to see strange things.

This idea also applies to “hearing” ghostly voices. You may have seen ghost-hunting shows in which people claim to record ghosts talking, and they play the recording back for the audience. The sounds on these recordings are called **electronic voice phenomena (EVP)**. EVP are generally recorded using an audio recording device. Then, the ghost hunter plays the recording repeatedly, trying to find a voice. While ghost hunters say that EVP happen when ghosts try to talk to us, scientists think that EVP are actually caused by static or background noise. These vague sounds are thought to cause a sound-based type of pareidolia: a type that causes us to hear words in meaningless noise. To most people, EVP probably sounds like a bunch of random noise, until the ghost hunters suggest something else. Usually, the ghost hunters tell the audience that the voice is saying something like, “Get out!” before they play the recording again. Suddenly, the EVP sounds exactly like it is telling the ghost hunters to get out. Humans have a talent for

ELECTRONIC VOICE PHENOMENA (EVP)

Random noises, like static, on electronic recordings that sound like background noise until someone points out that there is a voice speaking—then, words can be heard.

finding meaning in vague noises. Ghost hunters usually listen to these tapes expecting to hear voices, so their brains can play tricks on them. EVP are usually made up of unclear sounds, but when you *expect* to hear words in those sounds, you start to perceive them that way! This is the same explanation for why some pet owners can hear their dogs say, “I love you,” even though dogs cannot talk [2].

WHY WOULD SOMEBODY FEEL A GHOSTLY PRESENCE?

Although some people have never seen or heard a ghost, they still might say that they have felt a ghostly presence. Just as we sometimes see things that are not really there, sometimes we *do not* see things that *are* actually right in front of us. This is called **inattentional blindness**, and it happens to everyone. Inattentional blindness occurs when we are paying attention to one thing, but miss something else because we were not expecting it. For example, if you are watching your favorite TV show, you might not notice the dog come into the room and take a stuffed animal from the couch. If you strongly believe in ghosts, you are more likely to blame a ghost for taking the stuffed animal, rather than correctly guessing that the dog did it [3]. Inattentional blindness can even make you “feel” like a ghost is in the room with you.

You also might feel a ghostly presence when what you feel does not match up with what you think is happening. Recently, a team of scientists re-created the feeling of a ghostly presence in their lab, using a robot. Participants were blindfolded and asked to reach an arm forward to poke a robot with their pointer finger. When participants touched the robot, they also moved their pointer fingers around however they pleased. While they did this, a second robot hidden behind them would copy their movements and touch their backs. When the hidden robot copied participants’ movements perfectly, the participants felt like they were reaching forward and somehow poking their own backs! When the hidden robot moved slightly more slowly than the participants, the participants said they felt like another person was touching their backs. They also said this made them feel an invisible presence in the room, which they described as different from the participants themselves, the scientists, and the robot—kind of like when you feel a ghostly presence in a dark room [4].

Seeing, hearing, or feeling a ghost may not be as scary as our minds make it out to be. It is just the brain’s way of keeping us safe and preparing us to respond. In the end, though, it can be fun to be scared. Hopefully, knowing how the brain produces these responses will not ruin the fun of the next spooky ghost story you hear!

INATTENTIONAL BLINDNESS

A term for when your brain ignores something that is right in front of you because you were paying attention to something else.

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YOUNG REVIEWERS

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We are 24 students who get along very well, are interested in learning and excited by new experiences. We are smart, cool, funny and loyal. We always have each other's backs and always support and cheer up who needs comfort or is feeling down. We come from different towns, but we immediately became great friends. Each of us is different, we do not share the same interests, skills and qualities, but our diversity is what makes us unique and special.



**MRITTIKA, AGE: 15**

Mrittika loves hanging out with friends and family. Her interests include: playing the viola, dancing, singing, reading, and calligraphy. Math, Social Studies, and Music are her favorite subjects and she enjoys volleyball, karate, and running. Mrittika's favorite accomplishments are becoming a senior editor on her yearbook editing team and being a publicist for her school's Drama Department. She received an award for being the best foreign language student of the year in middle school and is a finalist in a nationwide computer science competition. Mrittika aspires to be a more open-minded and knowledgeable person.

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