Paranormal Misinterpretations of Vision Phenomena

We can actually see things that aren't really there in front of our eyes. Simple activities can help us to understand the real causes of such phenomena and to reject paranormal interpretations.

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Are they auras or afterimages? Vitality globules or white corpuscles? Angels or phosphenes? What we believe often determines what we see and experience. Some simple activities can help us understand vision phenomena that may be misinterpreted as evidence for the paranormal.

Auras

In a brief review on the aura, a "glowing field surrounding a human being," Perez and Hines (2011) mention perceptual illusions as among many possible reasons the belief in auras persists. Dale et al. (1978) suggest two vision phenomena that may be involved in a perception of an aura: border contrast effects and afterimages.

When uniformly shaded fields are presented adjacent to one another, we perceive them as non-uniformly shaded with enhanced contrast at the border. This visual illusion was first reported by Ernst Mach (1865), and it is often presented as "Mach bands" as shown in figure 1 (Ratliff 1965). Figure 2 presents the illusion as a series of silhouettes and shows how an aura might be perceived. In either case, the bands can be revealed as truly uniform if you cover the borders with your fingers. The illusion results from a process known as lateral inhibition, wherein neurons associated with adjacent photoreceptors on the retina can influence each other to emphasize a border.

With regard to afterimages, I cannot say it better than Blackmore (1996, 37), who wrote:

> If you hold out your hand against a dark background and look at the space just beside the skin, you will begin to see a faint glow around it. . . . Light skin against a dark background provides high contrast and good conditions for after-images. As the eyes move slightly but rapidly about (as they always do), an after-image builds up around the edge of the hand and produces a light blur.

Most people are well acquainted with afterimages, so the only surprise here may be that our eyes are always moving without our being aware of it. You can see this jitter by first staring for a minute at the circle where the grid lines cross in figure 3, which will "print" the image of the grid on your retina. If you then stare at the plus sign in the square, you should notice that the afterimage jumps around as your eyes move.

Figure 1. Mach bands

Figure 2. A series of silhouettes

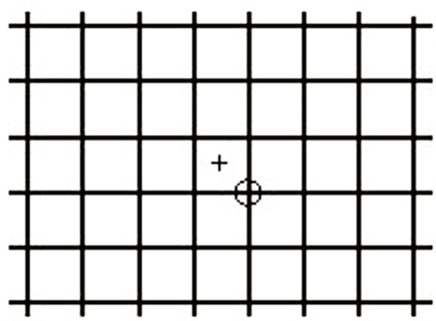

Figure 3. Eye movement demonstration (see text for explanation)

Vitality Globules

William Flexner informs us in *Introduction to Parapsychology* that any normal person can usually see what are variously called prana, vitality globules, or etheric globules. By "focusing the gaze intently into the sky for a few moments" (Flexner 2004, 128) you will see that the "globule wells out from an invisible source, appears and moves rapidly away, to give place to more globules" (147). Flexner writes that when we breathe in these globules of "raw energy" our bodies change them into "personal vitality" (128), so he clearly regards them as an atmospheric phenomenon that is beneficial to our health.

We can never be sure exactly what someone else is *seeing*, but what Flexner describes seems a lot like the blue field entoptic phenomenon (also called Scheerer's phenomenon or flying corpuscles). We sense light with the retina, which is at the back of the eye. Arteries, veins, and capillaries are present on top of the retina, and these plus the blood flowing through the capillaries can be seen under the right conditions. We see the arteries, veins, and capillaries as networks of shadows and the blood flow in the capillaries as numerous short-lived, seemingly erratic, rapidly moving dots of light with dark tails.

To see the larger blood vessels on the retina, close one eye and look straight ahead at a blank wall with the other while flashing a beam of light across the pupil from the periphery. This will cause a spot of light to be focused on the periphery of the retina. The spot acts as an internal light source casting shadows of the blood vessels on the retina. These shadows are not normally seen because the retina adjusts for any constant sensation. For other viewing techniques and more information, see Walker (1982).

Figure 4: Shadows of parafoveal capillaries on the retina (Horner 1834)

Under ideal viewing conditions, you can see dozens of these white cells moving at a time and recognize that they always trace out the same paths and move in time with your pulse.

To see the parafoveal capillaries on the retina, put a pinhole (~0.8 mm) in a business card and look at a bright, featureless surface (or the sky) while holding the pinhole close to your eye. Rapidly move the card in small circles, and through the hole you should see a pattern similar to that shown in figure 4. Note the capillary-free zone at the center of vision marking the fovea, where photo receptors are most tightly packed.

Most people have occasionally seen the blood cells moving through these retinal capillaries that surround the fovea when staring at a bright surface, particularly after physical exertion. The white blood cells are relatively large and must deform to fit in the capillaries, causing a space to open up ahead of them and the much more numerous and smaller red cells to pile up behind. The red cells absorb more light, so what we see are short, bright streaks with dark tails moving in the short, convoluted paths of the capillaries. Under ideal viewing conditions, you can see dozens of these white cells moving at a time and recognize that they always trace out the same paths and move in time with your pulse. To improve your viewing, you can hold a piece of cobalt glass or blue plastic up against a blue sky. A science museum (see www.exploratorium.edu/xref/exhibits/blood_cells_in_the_eye.html) or an ophthalmologist may have a viewer (sometimes called an entoptoscope), which is essentially just a bright, diffuse source of narrow-band blue light. For more information, see Sinclair et al. (1989) and Walker (1982).

Angels

Who knows what someone has actually seen when he or she claims to have seen an angel or a ghost? But some of the descriptions I have read sound like the person was seeing floaters or other entoptic (within the eye) phenomena. If you are really looking for and expecting to see an angel or ghost, just about any blurry thing you can't explain will probably do.

There are plenty of entoptic phenomena that look like blurry things, but I think floaters, phosphenes, and Purkinje's blue arcs are the most likely candidates for misinterpretation. Floaters are cells and tissue suspended in front of the retina. They cast shadows on the retina that can be very conspicuous when looking at a bright, featureless surface. If a floater is in your peripheral vision, you may become aware of it moving around but will not be able to get a clear view of it because it will move with your eye movement.

You can dramatically improve the visibility of floaters by holding a point source of diffuse light close to your eye. Put a small piece of aluminum foil on a hard surface and twirl a needle point on it to make a tiny hole (~0.2 mm). Cover the hole with matte-surface cellophane tape, and hold the foil close to your eye while looking at a bright light source through it. Light from the hole will be refracted by the cornea and lens to cast distinct shadows of things on and inside your eye as shown in figure 5. If you move the foil back and forth and up and down while continuing to look straight ahead, you will be able to gauge the relative distance of various things from the retina as well as see more of the eye's interior. Moving your head relative to a horizontal plane may also result in some of the floaters moving closer to the fovea where the shadows can be seen more clearly. See Walker (1982) for more information.

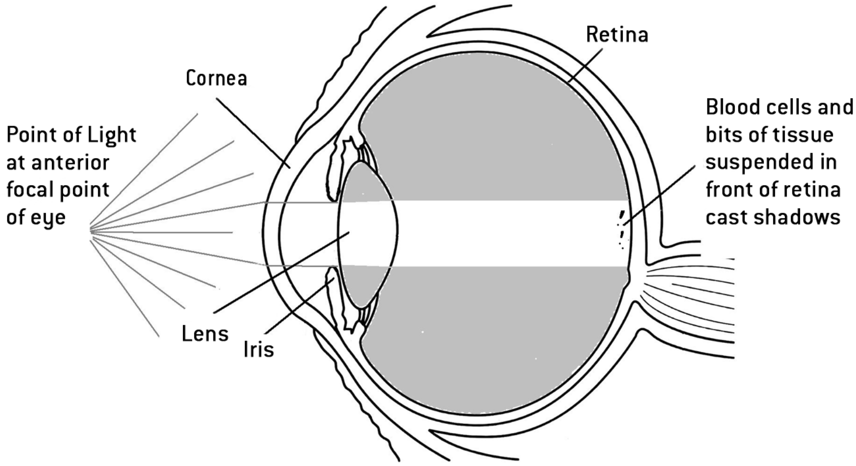

Figure 5. Seeing floaters clearly

When you press on one corner of your eye, you can activate the photoreceptors, causing you to see a spot of light on the opposite side of the eye. This perception of light when no light is entering the eye is known as a phosphene. A rapid movement of the eye can also result in a phosphene at the optic nerve because the retina is apparently stretched there (Friedman 1941). If you do this at night, it can be quite noticeable, but only for the first one or two attempts—and you can't see it very clearly because it is fifteen degrees from your center of vision where visual activity is substantially less. See Walker (1981) for more information on phosphenes.

The photoreceptors can also activate spontaneously. This is why even in the total absence of light you don't see absolute blackness but instead a mottled gray called "dark noise" or "equivalent Poisson noise" (Elkins 2000, 241). With a little imagination you can "see" all kinds of things in this noise.

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Purkinje's blue arcs are my favorite entoptic phenomenon both because of their beauty and because, as Richard Gregory (1997, 57) wrote, "Here we are seeing parts of our own brains!" There is nothing paranormal about it, but people may be tempted to misinterpret it because the phenomenon is fleeting and difficult to reproduce. To see these arcs clearly, go into a windowless room that contains a small LED indicator light (preferably red). Close your eyes and turn off the lights. After about thirty seconds, open just your right eye and look at the right edge of the LED. You will momentarily see two faint but distinct blue arcs streaking a distance of

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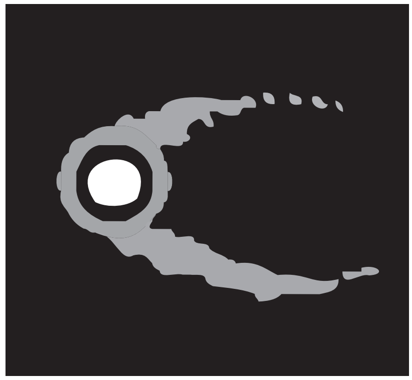

Figure 6. Purkinje's blue arcs (Purkinje 1825)

five or ten degrees from the light toward the right (see figure 6). (Your thumb held out at arm's length has a width of about two degrees.) If you then look directly at the light, you may see a faint blue haze around it. If you look to the left side of the light, you will see a blue spike where the arcs were. Stable images on the retina disappear quickly, but you can prolong the phenomenon by shifting your eye back and forth or by switching to your left eye for the reverse view. You will eventually need to turn the lights on and repeat the process when your eye becomes accustomed to the dark. What you are seeing is due to the action of the nerves on the retina that connect the photoreceptors in the center of vision (the fovea) to the optic nerve about fifteen degrees away. These nerves arc around the fovea, which is why you see arcs when you look at the right edge of the light with your right eye but only a spike when you look at the left edge. Because the eyes develop from the brain, these nerves are considered part of the brain. See Walker (1984) for more information.

Conclusion

Subjective visual experiences can be very hard to evaluate. The images on our retinas can result from objects and processes within the eye itself. If we are ignorant of these phenomena, we will not consider them when trying to interpret things we are seeing. The photoreceptors on our retinas are not perfect transducers: they respond to stimuli other than light; they are noisy (as evidenced in the dark noise mentioned earlier); there is a lag in their response time; and they become saturated, requiring time to recover. Vision is a brain process that starts at the retina, turning discrete signals on a two-dimensional surface into the perceptions of lines, surfaces, shapes, and three-dimensional objects in an external world. This process is influenced by expectations and preconceptions as many visual illusions demonstrate (see www.michaelbach.de/ot/). ■

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