

A PIECE OF MY MIND

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On Vision and Perception

They have eyes to see, but do not perceive.

Ezekiel 12:2

The concept of vision has fascinated me since childhood. As a fourth-grader, I recall arguing with a classmate over whether the basketball we were playing with was red or orange. Later, I realized that perhaps my friend and I were not arguing at all: what he had called red was what I had been taught to call orange. Training and a shared education lent convergence, but no precise agreement. Perceptually, my yellow could be his green, and my green his blue. Perhaps my eyes painted the world in colors very different than someone (if not everyone) else's eyes.

By the time I was an eighth-grader, recess and art had long been supplanted by history and science. With a native skepticism and hubris of one viewing antiquity through the lens of modernity, I studied the great Greek thinkers, baffled. How could Aristotle, reflecting on the lessons of his teacher Plato, teach that the eyes are "lightened by reason of the sun," where "beams of sight that pass from the eye ... go directly unto the thing that is to be seen," and that blindness was attributed to a failure of "the strength of light to be carried from the brain to the eye"? Did these Greeks really believe light traveled from the eyes, rather than toward them? How silly, I thought.

My skepticism deepened in high school as I moved on from the Athenians and came to appreciate perhaps the deepest of European thinkers, the philosophers. Hume challenged me: to him, my subjective experience in life is simply a perception, and thus, the way I view the world with my eyes must simply be the mere external venue of this perception. However, Sartre, eschewing a loftier veneer of existence, may have disagreed, arguing that the only thing that matters is what I do with what I see, in a very rugged, terrifyingly authentic, and concrete existence. In other words, it does not matter whether I call red what my friend calls orange. It does not matter if vision and blindness were gifted or inflicted upon us by the sun or by the gods. What matters is how the product of my eyes affects my everyday existence.

The existentialist's notion of vision carried me through college, where I studied chemistry and classical history. There was no room for the qualitative appreciation of vision; indeed, every color was determined by nothing more than a specific frequency of light, composed of discrete photons of energy. Regardless of the name, the frequency of 450 nm would register the same in all eyes. In the same vein, I learned in physics that light behaves in predictable ways. Snell's law dictates the angle a ray of light bends in water just as optics determines the way light translates onto the retina. It would seem red is red, and orange is orange, whatever name I wish to give it.

I embraced this view until medical school. Two years of anatomy and basic science taught me what Galen discovered—that all eyes have a sclera, cornea, lens, and retina. Specific pathology results in recognized patterns of disease; for example, an opacified lens predictably results in a cataract. With clinical exposure, I learned that a cataract is surgically corrected with the replacement of the faulty lens with an optically superior synthetic lens, one that does not accumulate proteinaceous residue.

Upon reflection, I approached research in ophthalmology as an idealist, wanting to make practical contributions to the field via translational research in the laboratory. I believed that agents targeting neovasculature and hypoxic tumor regions would effectively cure ocular malignancies. However, after the majority of a decade of research, I realized that things were not so simple. As in the Greek legend of Hercules battling the formidable multiheaded Hydra, it seems that research results in more questions than answers and that each question tackled implied new questions, exponentially. Uncertainty and hypotheses had supplanted the comfort of precise anatomical drawings from medical school; to me, the nature of vision was, by the day, less clear.

And then I met Hadar, a 26-year-old student caught in the middle of the 2006 conflict between Israel and Lebanon. A Kassam rocket fired by militants had destroyed her home, while she was inside it. She was left blind. Yet with her other senses, she continued to perceive the world. Her portrait of her environment was simply different from mine. She still perceived her surroundings in a nuanced way, with scent, touch, sound, and temperature. While the eyes let us "see" the world, Hadar taught me that vision is far from a one-dimensional inevitable consequence of optics and anatomy.

My grandfather further reinforced for me the disconnect between sight and perception. By age 93, my grandfather with normal-pressure hydrocephalus no longer recognized me, though his vision was very much intact. My earlier focus on wavelengths, frequencies, and anatomy was akin to claiming four wheels and an engine comprised an automobile.

Later I came across Jorge, an impassive 24-year-old Afghanistan veteran with posttraumatic stress disorder, who made me realize that while I may know something about vision, I understood absolutely nothing at all about perception. An IED explosion tearing two of his comrades apart in the notorious southern Kandahar province left this soldier with absolutely expressionless eyes, eyes that no longer wished to see. Nothing I had encountered in philosophy, history, physics, or medical school could explain Jorge's vivid flashbacks and his unblinking, blank stare.

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It has become clear to me that the subjective experience of vision and perception is independent of mechanistic medicine. I see now that the components of sight—vision and perception—are very distinct. One could have intact eyes and still be functionally blind, or be blind and yet have intact perception. Hadar, my grandfather, and Jorge altered my understanding of vision as fundamentally as the blow quantum mechanics dealt Newtonian physics; indeed, mass and energy are interchangeable. Was I a Euclidian, arguing that two parallel lines, by definition, never intersect, or a follower of Lubachevsky, countering that two parallel lines will inevitably intersect within a sphere?

Slowly, I have come to understand that perhaps a line could be described as linear and spherical at the same time, simply depending on the magnification or distance of the viewer. As I embark on a residency in ophthalmology, I realize that perhaps I had it right as a fourth-grader all along: the same event can be labeled as red and orange, parallel and perpendicular, joyous and sorrowful, light and cumbersome, tedious and fascinating, linear and circular, simultaneously. All people experience the world in a vision that is in some ways predictable, yet always individual, unique in all the ways that matter.

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Vision is the art of seeing things invisible.

Jonathan Swift (1667-1745)