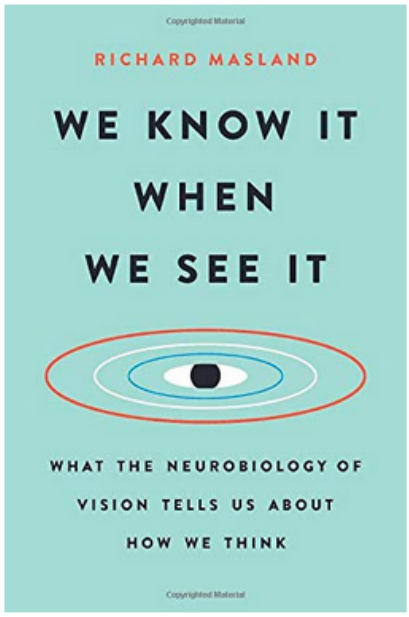

Full Title: We Know It When We See It: What the Neurobiology of Vision Tells Us About How We Think

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Reviewer: Sahar Joakim

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Masland's central topic is *visual perception*. Rather than discussing how we perceive (without looking) that something is crawling up our leg, this book is about how we visually perceive an object *as that object*. You open your eyes and see your daughter. You not only see something rather than nothing. You not only see a person. You instantly recognize the person *as your daughter.* You recognize her no matter if she is in-person or speaking over a virtual connection. You effortlessly recognize her no matter if she is sad with her head tilted down, happily singing, in a blurry photograph with make-up, or covered in mud. While it seems we recognize faces instantly and effortlessly, this book explicates visual object recognition from start to finish.

In Part I, Masland explains how the eyes receive, fragment, and transmit information.
Even the most thorough inquiry into human eyes would result in an incomplete understanding of visual perception. For vision, Masland explains, parts of the eyes coordinate with parts of the brain. The brain gives meaning to the data eyes work to collect. In Part II, Masland explains how the brain receives fragmented information, categorizes, and interprets it. The brain works like a spiderweb composed of nerve nets rather than a telephone system with point-to-point connections. In other words, most things in our brain communicate with everything else. In Part III, Masland leaves us where the science stands in contemporary times. We end with (supportable) speculations about perceptual learning and both human and artificial intelligence.

Chapters one through ten discusses the eye, brain, and eye-brain relationship. Masland explains how the retina ignores some fragments of a visual image and sends other fragments as a signal to the brain for interpretation. Five (main) classes of neurons making up the retina *decide* which inputs to pass on. Different parts of the brain, specifically, six patches of the temporal lobe, coordinate and learn how to recognize (for example) faces. These patches also adapt to neural damage to continue recognizing object's faces. Masland explains how brains *learn to recognize* through neural circuitry. When something is important, the brain changes to efficiently recognize

it. We see a triangle *as a triangle* even if there is a chunk of one of its lines missing and whether the triangle is clear, blurry, dotted, or tilted. The brain, itself, is biased. We understand only a small portion of the brain both in general and of its parts, such as the (primary) visual cortex. Masland notes what is standard in the literature and what is speculation. Simple diagrams support the text.

This is no textbook. In every chapter other than Chapter Eleven, content sways between historical context, brief biographies of major players contributing to literature, reminders concerning evolving technology for experiments, facts about anatomy, biology, computer science, neuroscience and neurobiology, and facts about object recognition. We learn as much about a scientist's research as we do about their personality and interests beyond the laboratory. Readers feel as if they are living through the generations breathing in the scientific culture as laboratories waste tax-payer funding and scientists are paying to use their own discoveries.

Masland answers how we recognize faces as such in Chapter Eleven. There, he presents only a few examples, analogies, asides, or background. When textbook terms are necessary, the glossary is a page turn away. Chapters Twelve through Fourteen return to Masland's typical style. Chapter Fourteen discusses philosophical questions concerning intelligence and consciousness. Strictly speaking, Masland explains, whether our cognitive mechanisms imply conscious selves is beyond the scope of what is provable (given contemporary starting points).

The book is inviting. It is neither watered down nor littered with jargon. Relatable analogies and examples help the reader lacking training in neurobiology to process the material and help the trained reader remain thoroughly engaged. During an analogy about nerve impulses, we learn that electricity flows down a wire at about 300,000,000 meters per second. Learning the details of synaptic communication, we learn that a variety of fat (lipid) composes cell membranes that enclose neurons composing the retina which collects data for perception. As another subtopic, we learn about how neurotransmitters work. We learn the sense of touch as a precursor to vision, and the role of nerves in interpreting pressure on the skin as meaning a mosquito has landed on our wrist. Our fingertip is covered by many tiny nerve endings whereas there are a few large nerve endings on our back. The differences between kinds of receptors in the skin are explained in terms of a snare drumstick and a bass drumstick, they look different and make different sounds though they are both sticks. These examples only scratch the surface of the mountain of reasons this book is the perfect balance of welcoming, intriguing, and informative.

Masland connects vision to other puzzles and makes neurobiology intriguing to a wide range of scholars. For marketing, for example, the transient cells in the eyes explain why flashing signs (with their sudden appearance) are so noticeable. For computer science, for example, he suggests that studying the image processing mechanisms of bird's visual systems (such as the hawk) can significantly enhance computer programs.

For only $29.00 USD, lifelong learners will read this for fun. Expect this book to be regularly recommended for undergraduate or graduate courses in biology, neurobiology, microbiology, anatomy, or cognitive science. Philosophers (studying the mind, agency, or consciousness) should not skip Chapter Fourteen.