Review: *The Mind's Eye*

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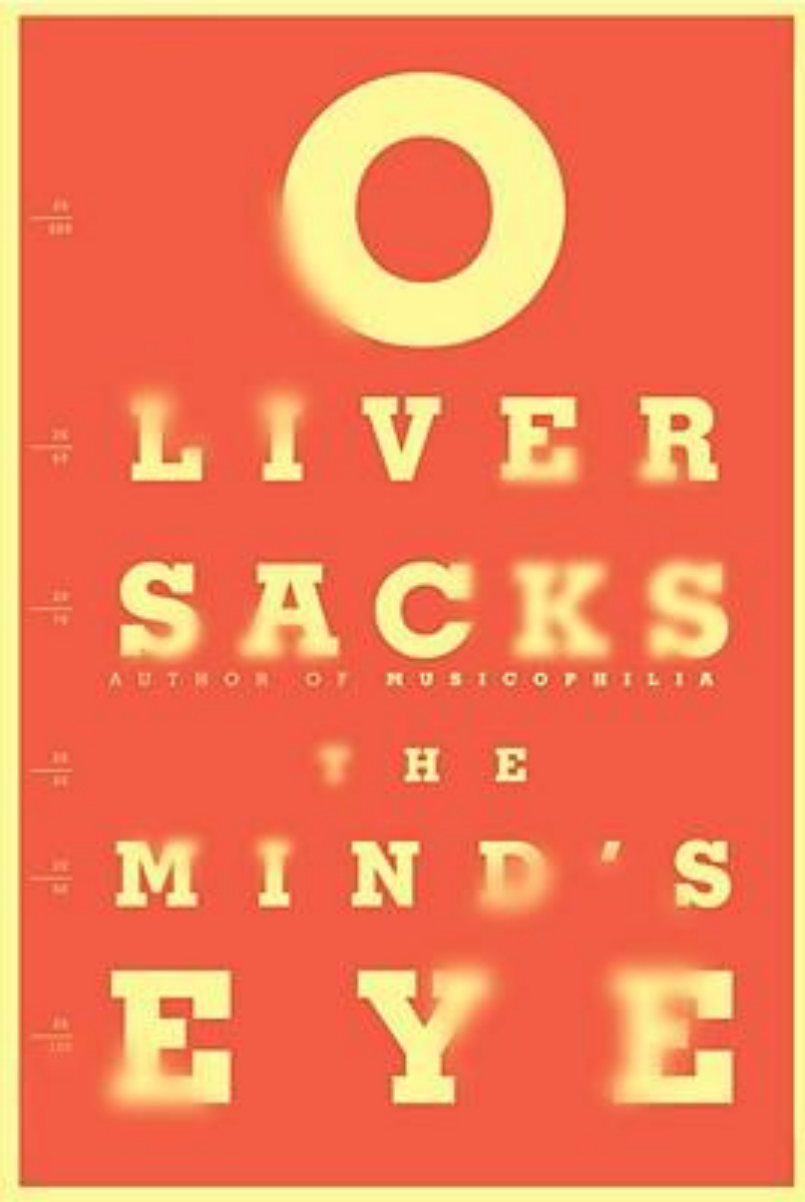

Alfred A. Knopf, 2010

Review available online at http://dana.org/news/cerebrum/detail.aspx?id=30766

Neurobiologists are commonly too preoccupied with collecting enough data from whatever specimen they are studying to be able to give a statistically credible account of their findings. Often, they do not realize how much sterling information about the operations of the brain can be derived from a detailed study of single patients with damage to various parts of the nervous system. Long before the advent of sophisticated electrophysiological devices and brain-imaging techniques, clinical neurologists had given detailed accounts of syndromes resulting from damage to specific parts of the brain. Many of the syndromes they described seemed so improbable as to be relegated to oblivion, only to be resurrected later when more "advanced" techniques became available. One such syndrome was cerebral color blindness (cerebral achromatopsia), which results from a specific lesion to what we now know is in the color center of the brain; scientists dismissed it as a manifestation of a hysterical state. Other reports, as with George Riddoch's description of patients who, after being blinded by lesions to their visual cortex produced by bullets, could nevertheless still see visual motion crudely but clearly were dismissed as being simply inaccurate, although we now have a good explanation for the phenomenon. Yet others, as with Joseph Jules Déjerine's description of a patient who lost the ability to read while retaining the ability to write (the syndrome of alexia without agraphia), lay dormant for decades and more, until verified by more recent observations.

Oliver Sacks' brilliant new book shows how misguided we are in ignoring such descriptions. *The Mind's Eye* is the result of a personal misfortune that afflicted Sacks' vision in one eye. This deprived him of the stereoscopy to which had had been so attached, altered his lifestyle, and made him, as he puts it, the only monocular member of New York's Stereoscopic Society. But Sacks' misfortune had another, highly productive effect. It got him thinking deeply about vision and the clinical literature attached to it; about what his altered vision, as well as that of others, tells us about the brain's operations; about the hidden and commonly untapped resources of the brain; and about what the variability in the consequences of going blind tells us about the brain's plasticity. Sacks presents the results of his deep thinking in this book, which I hope everyone even remotely interested in the workings of the brain will read with care.

In his enjoyable and highly readable style, Sacks begins by describing the specificity of certain syndromes and the specificity in the organization of the cerebral cortex that can be inferred from them. Perhaps unintentionally on Sacks' part, this section of the book constitutes a testament to a significant feature of cerebral organization—the functional

specificity of the brain's various parts—which scientists have challenged in vain ever since Broca located the cortical zone responsible for articulate language.

We learn from Sacks' account how people who have had strokes can lose the ability to read without losing the ability to write, or lose the ability to recognize the identity of a face without losing the ability to recognize the expression it carries. Others lose the ability to read musical scores without losing the ability to play them brilliantly, or lose the ability to see shapes while retaining the ability to see colors. Collectively, these cases provide an excellent conceptual introduction to the functional specificity of different parts of the cerebral cortex. This information is available in the specialized clinical literature; it is also available in the hundreds of anatomical and physiological papers that describe the specificity of brain area functions and connections. But Sacks brings it to life and summarizes it in an exciting way for the layperson and the clinician alike.

Sacks explores the richness of the brain's perceptual apparatus, which may account for the variability in what people experience after becoming blind. His thought-provoking descriptions of the consequences of becoming blind—or of (re)gaining a visual faculty that was lost or never existed—convey a physiological challenge. Over the past 50 years, physiologists have proposed that our visual apparatus is ready at birth but needs to be nourished during a critical period in order to function properly. Once so nourished, it becomes more or less stable for life. If deprived of sensory input, on the other hand, the individual becomes visually "blighted" for life.

Sacks' descriptions are not quite in accordance with such a picture. Some patients who are blinded lose both the capacity to imagine things visually and the very idea of seeing. For others, the visual imagination remains intact or even improves. The clinical literature on people born with congenital cataracts and to whom vision was restored in later life paints a picture of confusion, as if patients felt the "restoration" of their vision was a curse. But Sacks' account shows that at least one patient, Sue, was delighted to see stereoscopically for the first time later in life; she remarked that she had no idea what she had been missing.

All of this leaves Sacks, and us, with a profound puzzle. How hardwired is the brain, and, conversely, how plastic is it? Why do some blind people lose even the idea of seeing, while others develop a profound sense of inner vision, enabling them to undertake independently what might be considered visual tasks? To what extent, and how, do nonvisual areas and functions take over from impaired cortical areas rendered silent by retinal blindness? These questions remain unresolved, but Sacks brings the manifestations of the mechanisms, if not the mechanisms themselves, vividly to life.

Perhaps the most fascinating and moving part of the book is Sacks' incisive description of his own loss of vision in one eye as the result of a retinal melanoma. He is fascinated by what Russian neuropsychologist A. R. Luria called "the central resonances of a peripheral disorder"—the almost convulsive cortical processes that are unleashed when the brain no longer receives the input it used to process. From the gradual degradation and metamorphosis of his visual capacities in response to retinal damage, Sacks seeks to learn something about how the visual brain functions.

Sacks is disturbed by, but somehow also enjoys, the persistence and detail of afterimages and wonders what physiological insights they may give. He is puzzled by how he can "amputate" an object out of existence at will by simply "scotomizing" it (by rendering a part of his visual field blind). He is surprised at the vast difference between the picture he gets through one eye and the one he sees through the other. Although Sacks is apprehensive about the progress of his retinal melanoma, his thirst for knowledge about visual mechanisms seems to motivate him in his struggle.

Through all these bizarre experiences, Sacks seeks to learn, and then to learn more, about what he did not know. In the process, he teaches his readers as well. There is no element of self-pity; indeed, he makes almost no reference to the disorienting feelings that he must have experienced, except one perhaps vulnerable aside: "Questions of love and work, of what really matters most, have taken on a special intensity and urgency."

Toward the end of the book, Sacks turns to hope. He speaks of powerful images that the brain creates through means other than vision, and of past visual images that can create new visual worlds through the powers of visual imagination. Perhaps those of us with unimpaired vision underrate and under-use our imaginative capacities, which become more manifest when we are deprived of what once seemed so effortless and reliable. Perhaps, Sacks seems to be saying, we could tap into this power even when our vision remains intact.

In his book *Spiritual Exercises*, Ignatius de Loyola, founder of the Jesuits, places great emphasis on visualizing the suffering of Christ through daily exercise, "to see through the eye of the imagination" the physical places where Jesus or Mary had been in order to understand their suffering more completely. Through his descriptions of patients who have lost their sight, Sacks tells us that the eye of the imagination is there, and we can tap it forcefully if only we make the effort. Who knows what marvels this effort could generate? After all, Ignatius' advice had a deep influence on painters, who developed ever more imaginative techniques to project the illusion that they were depicting a witnessed scene, and thus engaged the viewer emotionally at a more powerful level.

On his quest to tap the imagination, Sacks turns to the seemingly endless possibilities of language. He writes, "Language, that most human invention, can enable what, in principle, should not be possible. It can allow all of us, even the congenitally blind, to see with another person's eyes." This is a paradox indeed, but above all it is a hugely interesting problem for the neurobiologist.

It may seem paradoxical to say that, after reading a book inspired by personal misfortune, I was exhilarated. Yet *The Mind's Eye* is an exhilarating book, perhaps precisely because it was built on misfortune. Sacks describes the visual apparatus of the brain and its vulnerability in lucid prose. The shattering realization that what was once so effortless is gone forever, along with the ways in which different patients—including the author—have dealt with their misfortunes, tells us something about the bravery and the resilience of the human spirit. And that gives us hope.

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