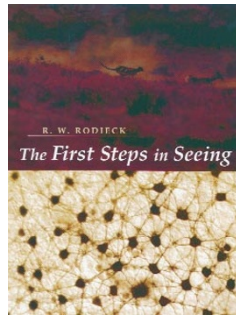


The sensational retina



The First Steps in Seeing

by R. W. Rodieck
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Reviewed by Helga Kolb

Over the last thirty years, a period that spans the career of Robert Rodieck, our knowledge of the visual system has undergone exponential growth. In the early days one could read and absorb almost all the important advances in vision research, including such diverse areas as psychophysics, electrophysiology, biochemistry, genetics and clinical findings. Today, in contrast, it is difficult even to be current in our own subspecialties, and it seems impossible for any one person to distill and synthesize the essential facts that underlie the perception we call 'seeing'. Nevertheless, in this amazing book, Rodieck has almost managed to do so. He synthesizes our understanding of the eye and retina in a way that is at once enjoyable to read, clearly presented and gorgeously illustrated. Complex subjects, ranging from biochemical pathways to the mathematical underpinnings of the relevant optics, chemistry and photometry, are elegantly explained. The reader is often walked through complex scientific principles with simple diagrams, metaphors and comparisons drawn from nature, so that we are all given an 'Aha! That's how it must be' feeling.

Many of the chapters provide insights into sensations that we all take for granted, making readers analyze for themselves what must underlie the different aspects of vision. Short exercises and stories sidetrack us briefly, but they are entertaining and make for fuller comprehension. The book should be read from chapter one to fourteen in sequence; it follows a progressive path, beginning with the problem of how the

head and eyes move to track and focus the image on our retinas, moving on to how a photon stimulates a photoreceptor, and ending with a discussion of the wiring that causes different images, spatial, temporal and spectral, to be channeled to different sets of ganglion cells that inform the brain. The author draws many examples from the natural world, from cheetahs hunting gazelles to star-watching on camping trips in the Northwestern wilderness, and these colorful images help sustain a sense of anticipation throughout the book.

This is not a reference book, however, and one does not pick it up to find the latest information on a specialized topic, be it anatomy, physiology or psychophysics of the retinal aspects of vision. Nor is this the place to find a complete coverage of the subject or references to the original articles. Many readers will feel frustrated at not being able to trace the source of some of the author's more sweeping statements and conclusions. The critical reader will often ask "where did that piece of information come from," and more citations would have been welcome. Many giants in the field will find their research completely ignored, and in fact almost no living vision scientist is referred to by name in the text. The author has consulted with a group of colleagues for advice on areas that lie outside his own expertise. Unfortunately, the views expressed are often narrow, sometimes uncritical and occasionally open to other interpretations or not based on concrete evidence. For example, the coverage of the anatomical basis of the retinal color pathways will suit only a small group of *cognoscenti*, based as it is on findings that many experts do not yet consider to be well established. Many physiologists and biochemists may not care for specialized and bewildering

anatomical terms, and they may think there is too much anatomy in this book. Conversely, some subjects on which there is now quite a lot of information are dismissed by a 'we know nothing about this yet' statement. Furthermore, some areas of research that many would consider fundamental to our understanding of how the retina processes the visual message are not included in this book. Do not look here for any information concerning intracellular electrophysiology, ganglion cell physiology, neurotransmitter pharmacology or adaptation of the visual system, for you will not find it.

Instead, expect an entertaining book with a remarkable grasp of many aspects of eye function, as well as some innovative suggestions regarding how the visual message is processed from retina to visual cortex. The author has successfully accomplished his stated aim, which is to reduce the overload of information to a simple set of rules, and to explore the consequences of these rules. The book will particularly appeal to engineers, for it is mathematically and mechanistically based with great emphasis on circuit diagrams, from eye muscle control to the visual transduction cascade. Some readers may find the unusual terminology difficult to get used to. For example, the spectral sensitivity curves of the photoreceptors are expressed in frequencies of oscillation of photons (THz) rather than in the familiar nanometers of wavelength. Thus, the sensitivities of the three cone types in the human retina, instead of being plotted from left to right as short to long wavelengths, are plotted as low to high frequencies, that is long to short wavelengths.

The last third of the book consists of a series of short and informative sections that summarize in simple terms the physics, optics, statistical and biochemical formulae commonly used in quantitative analyses in retinal research. These chapters will be very useful for beginning graduate students or as a reference for finding definitions of units. There is also a nice list of measurements concerning different structures of the human eye and photoreceptors, which will be a useful reference source for the specialist. But it is the main chapters that will be the most enlightening and fascinating to all of us in vision research. The author has indeed given us all some new ways to think about the 'first steps of seeing'.

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