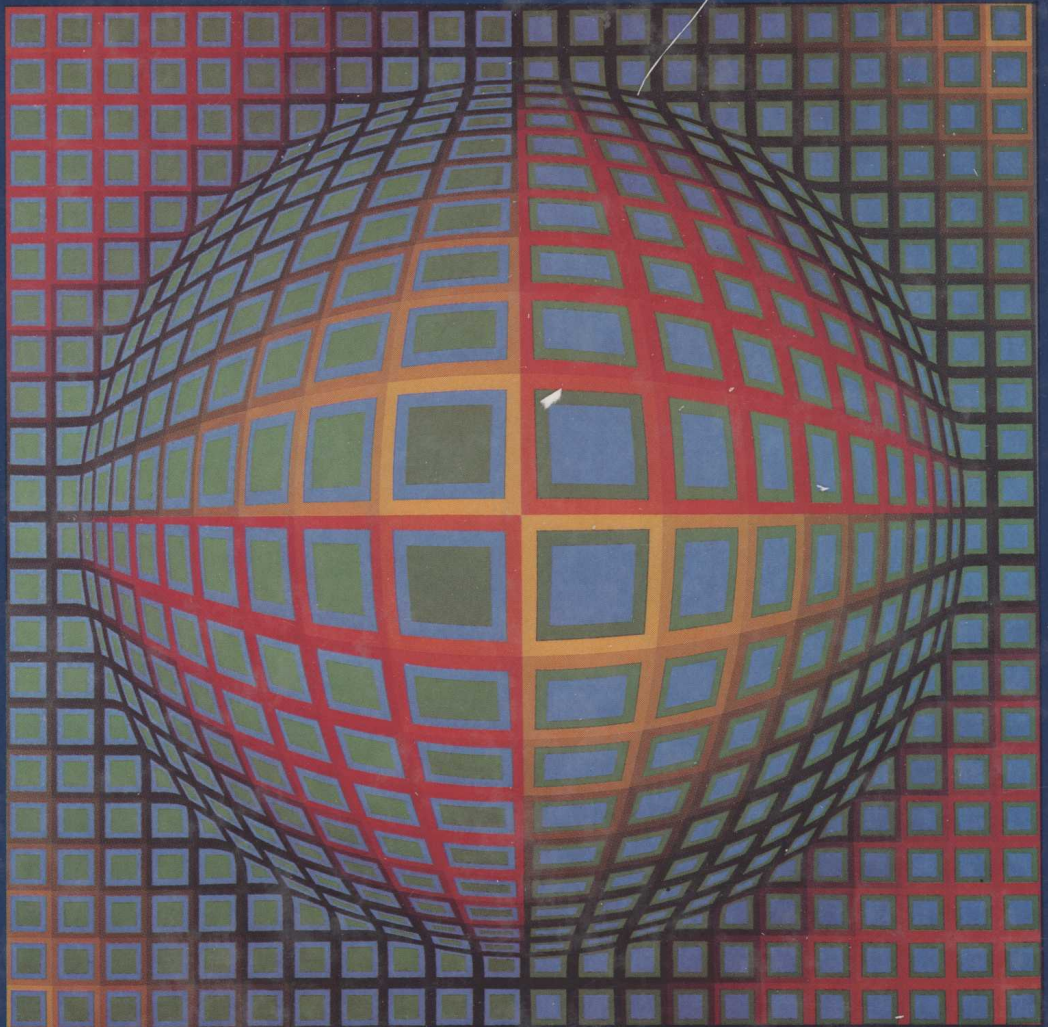


E. Bruce Goldstein

Sensation and Perception

Second Edition



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University of Pittsburgh

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In the preface to the first edition I expressed my feeling that to understand perception fully we must attack it from both the psychophysical and physiological points of view. This idea is one of the themes of this book, and one of my goals is to identify connections between perception and physiology. Another theme of this book is that while understanding how nerve cells fire may tell us a lot about nerve cells, this knowledge, in isolation, tells us nothing about perception. Nerve cells don't perceive. Only people and animals perceive. Thus, our study of perception must be centered on the psychophysical results that describe what humans and animals perceive. If we can connect these psychophysical results to what we know about physiology, all the better. But there is much we can learn about perception by taking a purely psychophysical approach.

The generous reception given the first edition plus the feedback I've received from colleagues and students has been extremely gratifying, and has motivated me to make the second edition even better than the first. In preparing for this revision I took a critical look at the first edition and, with the aid of feedback from many people, identified things that needed to be explained more clearly, topics that could be omitted, and, most important, topics that needed to be added. The result I have tried to achieve is a book that is not simply a collection of facts, but a book that tells a connected story in which the facts about perception are presented so we can make sense of them; so we can appreciate basic principles rather than isolated results.

Although those who have used the first edition will see much that is familiar here, they will also see much that is new. Some of the more important changes and additions include:

1. A completely rewritten section on signal detection, with a typical signal detection experiment described in Chapter 1, and the theory underlying the signal detection approach described in an Appendix.

2. Chapter 2, "The Physiological Bases of Perception," has been shortened and simplified for students with no prior background in the basics of physiology. New material on the use of the 2-deoxyglucose technique to map orientation columns in the visual cortex has been added.

3. A new chapter, "Perceiving Touch, Temperature, and Pain" (Chapter 4), has been added. The rationale for placing this chapter near the beginning of the book is that the first three chapters lay the groundwork for the student's understanding of psychophysics and physiology, emphasizing examples from vision, and these approaches are then applied to the skin senses, emphasizing parallels between the skin senses and vision. This chapter also introduces the idea that perception is influenced by the perceiver's expectations and past experience. This idea, which is introduced via a discussion of the psychological aspects of pain perception, sets the stage for some of the more "psychological" topics in subsequent chapters. Also included in this chapter is new material on nociceptors, cold and warm fibers, gate control theory, endorphins, and neurons that respond to "active touch."

4. The material on color mixing in Chapter 5 has been simplified, and additions to this chapter include some well-known old work on memory color and some just published work on "blob" cells—double color-opponent cells in the cortex that may mediate our perception of color contrast.

5. A new chapter, "What Can Go Wrong with Your Eyes" (Chapter 6), has been added. The motivation behind this chapter was one of curiosity: the curiosity of my students, who often asked me questions about various eye problems, and my own curiosity about what goes on during an eye examination and during operations for conditions such as cataract, glaucoma, and detached retina.

6. The chapter on form perception from the first edition has been changed into a new chapter, "Organization, Recognition, and Attention" (Chapter 7). The section that covered Gestalt psy-

chology in the first edition has been expanded to include the information processing approach to perceptual organization, with examples from both visual and auditory perception to emphasize the generality of the Gestalt approach. New material on models of pattern recognition and attention is also included.

7. The chapter on depth perception (Chapter 8) has been reorganized and new material on J. J. Gibson's approach to the perception of space has been added.

8. A new chapter on the perceptual constancies (Chapter 9) gathers together material on size, shape, and lightness constancy that was formerly covered in different chapters and adds material on perception as hypothesis testing.

9. Chapter 10, "Perceiving Contrast", includes new material on how an object's apparent position in space affects our perception of contrast and new material on the effect of spatial frequency on contrast perception. A clear description of the Fourier approach to contrast perception is included in an Appendix.

10. The chapter on perceiving movement (Chapter 11) now includes an expanded treatment of J. J. Gibson's approach to movement perception.

11. Chapter 12, "Perceptual Development" (formerly "Experience"), includes an expanded section on infant perception that has been updated to include recent work on infant acuity, contrast sensitivity, accommodation, monocular and binocular depth perception, and form perception. As in the first edition, this chapter still includes a detailed treatment of the effect of visual deprivation on neurons in the visual cortex of both animals and humans.

12. Chapter 13, "Basic Mechanisms of Hearing," has been reorganized and new figures have been added to help the student understand the structures of the middle and inner ear. New material on tinnitus and infrasound detection by homing pigeons has been added.

13. The chapter on speech perception (Chapter 14) has been completely rewritten to include material on the motor theory of speech perception, recent

work on acoustic cues for perceiving phonemes, audiovisual speech perception, and coverage of the controversy over whether the mechanisms responsible for categorical perception are linguistic or acoustic in nature. A summary of how phonemes are produced is included in an Appendix.

14. The material on olfaction and taste has been expanded so that these two senses now have a full chapter to themselves. (In the first edition they shared a chapter with touch.) New material on myths about human olfaction, cognitive factors influencing smell, the 2-deoxyglucose technique as applied to olfaction, the effect of genetic factors and past experience on taste perception, conditioned taste aversion, and specific hungers has been added.

In addition to the above changes in the text, this edition includes the following features:

1. Addition of highlighted words in the text and a glossary of over 500 definitions. Definitions are placed at the end of each chapter to make reviewing the key terms in each chapter easier for students.

2. Over 180 new drawings and photographs.

3. Over 200 new references.

One of my goals in writing this book was to transmit some of the excitement about perception I have experienced in both my physiological research on visual pigment chemistry (Goldstein, 1967, 1978) and my psychophysical research on picture perception (Goldstein, 1975, 1979) and attention (Goldstein and Fink, 1981). I hope in reading about the research described in this book you will sense this excitement and you will see that perception is more than just a list of "facts." After all, perception is something we experience all the time, and the study of perception can enhance this experience. I've found that studying perception has made me more observant of my environment, more aware of my perceptions, and more appreciative of the miraculous process that transforms energy falling on receptors into the richness of experience. I hope reading this book has the same effect on you.

E. Bruce Goldstein
Pittsburgh, November 1983

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