BOOK REVIEW

Vision: Coding and Efficiency

Colin Blakemore, Ed., 448 + xv pages, ISBN 0-521-36459-0, Cambridge University Press, 32 East 57th Street, New York 10022 (1990) $34.95 softbound.

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For more than 35 years, vision scientists have been studying a wide range of topics associated with biological systems, such as the organization of the visual pathway; the function of the visual areas of the brain; the detection of light, color, contrast, movement, depth, dark, and light adaptation; and computational models of visual routines. A preeminent figure responsible for initiating much of this work is Horace Barlow of Cambridge University. This book is the result of a conference held at Cambridge University to honor Barlow in his 65th year. As the editor, Colin Blakemore, says: "Every contributor to this book has studied or worked with Horace Barlow, or has been a close colleague, happy to acknowledge her or his debt to Barlow. There could be no better tribute to the extraordinary breadth of Barlow's own contributions and his influence on others."

The unifying theme of this book is the efficiency of coding in visual systems. Although the book is biologically oriented, the electronic imaging readership will find major portions of the book very understandable and highly valuable. The book is organized into sections that group chapters addressing a common topic, such as "Concepts of Coding and Efficiency," "Development of Vision," "Motion," and "Depth and Texture" to name a few (see the end of this review for a complete table of contents). In reading through this book, I mentally resorted the chapters into the following questionlike groupings: (1) what can an (electronic) imaging scientist learn from the results of biological vision; (2) how do electronic and biological systems compare in the performance of basic visual tasks such as edge detection, depth estimation, or texture discrimination; and (3) what aspects of electronic imaging have benefited most from our understanding of the analogous aspects of biological imaging systems. Readers will find that the book contains a comprehensive treatment of each of the preceding questions. What lends special credence to the contents of the book is that it contains a recapitulation or description of many fundamental concepts related to electronic imaging systems or biological vision in the words of the original researchers themselves.

There is exhaustive material relating to the quantum efficiency of vision, coding efficiency in visual processing, and the statistical limits to image understanding. Several chapters are devoted to the treatment of color vision and deal with topics such as the role of the two subsystems of color vision in wavelength discrimination and the chromatic coding of space. Fundamental concepts of vision such as brightness, adaptation, and contrast are revisited and explained in light of recent developments in the field. Topics such as edge detection; feature extraction; binocular mechanisms; texture discrimination; the interaction between motion, depth, color, and form; and visual aftereffects are discussed in great detail. For the computationally inclined, several chapters can be found that contain algorithms and suggest architectures for efficient vision modeling. These include a chapter each on the algotecture (algorithm and architecture) of visual cortex and on pyramid algorithms.

The book is not meant for the uninitiated and is certainly not for someone in search of a cookbook of algorithms that "get the job done." Readers with prior exposure to image processing or computational aspects of vision will easily appreciate the richness and relevance of research reported in the book. Practicing imaging scientists, especially those seeking to develop new algorithms to address practical issues such as color portability, constancy, and perceptually salient edge detection for compression, will find valuable cues in the form of theoretical and experimental results in this book. Those in academia will certainly find the book packed with many seeds for future thought.

The editorial quality of the book is excellent — true to the excellent tradition of Cambridge University Press. A first reading did not reveal any typographical errors. All the pictures in the book, both color and grayscale, had an acceptable quality. A comprehensive subject index is provided. Although each chapter has its own collection of references, a comprehensive list of references or an author index at the end of the book would have been a useful addition. Unfortunately, also true to tradition, the book is highly priced and will make many a student reader settle for the usage of a library copy. This book represents a valuable collection of archival contributions and is strongly recommended for every technical library. The book has a large number of chapters (38). A complete listing of chapters might normally be construed as inefficient "coding." In this case, however, the chapters are very independent from one another. This is not a textbook with a canonical structure in which the contents might more or less be "understood," at least at the chapter-title level. A complete chapter listing is therefore provided next, with the section titles in boldface.