

Reviews

Vision: a computational investigation into the human representation and processing of visual information by D Marr; W H Freeman, San Francisco, CA, 1982, 397 pages, \$29.95 (UK: £22.50)

David Marr's book *Vision* is an important work and deserves a wide audience. In its scope the book is remarkable, starting with speculations about the very earliest stages of vision and proceeding right up to the level at which 3D object shapes have been analyzed and represented prior to recognition. Taken in, en route, are the topics of edge detection, stereopsis, motion, and many others. Even if it turns out that the human visual system is not built along the lines Marr has suggested, the book will still have been valuable because, in addition to these rather detailed topics, it represents a serious attempt to discover what a theory of vision should be.

In the decade preceding his death in 1980, Marr conducted a fruitful series of unconventional studies, in collaboration with his colleagues at MIT, aimed at illuminating different aspects of vision. The studies were unconventional in that he drew his inspiration not from experimental studies, but from certain constraints that appear to apply lawfully in the world around us, and in its projections onto retinæ. These indicated conditions which the visual system, and any valid model thereof, might be expected to meet. This book is in part a synthesis of Marr's papers on these subjects, and much of the central section of the book will be familiar to readers of the papers.

Happily, Marr has chosen an easier style in the book than that of the papers, and that work should now be more widely accessible. Unfortunately, the use of mathematical formulations is not always helpful. Anyone interested in such would not need the assistance with $\nabla^2 G$ filters, which is offered on page 54, but would find some aid of this nature invaluable in chapter 5, where it is largely lacking. This is to be regretted, but it will not worry many readers. More readers may be concerned by the rather low significance attached to empirical evidence. For example, on page 75 he states "It is interesting that the visual system takes this spatial, physical approach so seriously". Marr certainly takes the approach seriously, but where is the evidence that the visual system does so? Many of the ideas in the book will prove difficult to test, especially where firm definitions are lacking, as in the discussion of place-token grouping in section 2.5.

However, the most important contribution of the book lies in the elaboration of a three-levels-of-description theme. Marr argues that there is a general level of understanding of the process of vision, which is quite independent of whose nerve cells comprise the hardware. This level, which, he argues, has been lacking in the past, he calls the computational theory. Roughly stated, it amounts to a list of those features of an environment that a visual system might wish to 'see' and an analysis of the natural constraints which could be exploited by the visual machinery in so doing. The purest computational theory starts with a physical assumption about the structure of the environment system and a biological assertion about which aspects of this structure are useful. The theory then proceeds to note that, as a result of the physical assertion, the environment system is constrained in an informative manner. This skeleton of the computational theory amounts to a form of applied geometry of considerable power and importance to vision, and it is in this respect that the true worth of the book lies.

Difficulties follow in trying to relate the computational theory level downwards to the specific details of human vision. In practice, one would identify a likely constraint in the visual image, and then proceed to ascertain the generality with which it may be applied. Some constraints are totally general, such as the constraint that both eyes are simultaneously viewing the same 3D world, albeit from different places. Other constraints are less general; for example, the occluding contour constraints that Marr discusses in section 3.6 only apply to distant views (parallel projection) of generalized cones. In cases of the latter variety, a full treatment of the computational theory requires an exploration of the consequences of using invalid constraints.

Marr's own treatment is rather worrying in this latter respect. Consider the stereomatching constraints in section 3.3. Marr describes three reasonable constraints, but two of them (numbers 2 and 3) contain the word 'almost', ie, they are not completely general. Marr proceeds to describe an

Hearing Research And Theory Volume 1

B Lingard



Hearing Research And Theory Volume 1:

Hearing Research and Theory, 1981 *Hearing — Physiological Bases and Psychophysics* R. Klinke, R.

Hartmann, 2012-12-06 The present book contains the original papers and essential points of the general discussion of a meeting organized in a series of tri annual conferences initiated by Dr R Plomp with the meeting in Driebergen The Netherlands 1969 These symposia have tried to bring to ether people from extreme fields in auditory research and to amalgamate their recent findings This series of conferences has proven to be most successful and has attracted much attention by scientists in auditory research The organizers have tried to maintain the character of the meeting with em phasis on discussion by precirculation of the full text of the papers and by re stricting the number of active contributions Unfortunately this forced us to reject a great number of submitted papers in selection we attempted to compose a fair survey of certain fields of auditory research but leave others untreated Because of the same reason the number of invited review papers had to be limited to three The reader may decide whether or not this selection was adequate We thank all those participants who attended the meeting inspite of the rejection of their paper The authors have been responsible for text and typing of their manuscripts The editors have not attempted to standardize the spelling *Loudness* Mary Florentine, Arthur N. Popper, Richard R. Fay, 2010-11-04 Loudness is the primary psychological correlate of intensity When the intensity of a sound increases loudness increases However there exists no simple one to one correspondence between loudness and intensity loudness can be changed by modifying the frequency or the duration of the sound or by adding background sounds Loudness also changes with the listener s cognitive state Loudness provides a basic reference for graduate students consultants clinicians and researchers with a focus on recent discoveries The book begins with an overview of the conceptual thinking related to the study of loudness addresses issues related to its measurement and later discusses the physiological effects of loud sounds reaction times and electrophysiological measures that correlate with loudness Loudness in the laboratory loudness of steady state sounds and the loudness of time varying sounds are also covered as are hearing loss and models *Hair Cell Regeneration, Repair, and Protection* Richard J. Salvi, Richard R. Fay, 2008-03-15 Not male pattern baldness but the loss of sensory hair is a very serious topic Sensory hair cells convert sound and motion into our sense of hearing movement and head position In mammals the loss of hair cells is irreversible Or is it Hair cells in other vertebrates are capable of regenerating and recovering partial or complete function This book provides a comprehensive survey of the regeneration of sensory hair cells *Auditory Computation* Harold L. Hawkins, Teresa A. McMullen, Richard R. Fay, 2012-12-06 The auditory system presents many features of a complex computational environment as well as providing numerous opportunities for computational analysis This volume represents an overview of computational approaches to understanding auditory system function The chapters share the common perspective that complex information processing must be understood at multiple levels that disciplines such as neurobiology psychophysics and computer science make vital

contributions and that the end product of computational analysis should be the development of formal models

Encyclopedia of Neuroscience, Volume 1 Larry R. Squire, 2009-06-12 The Encyclopedia of the Neuroscience explores all areas of the discipline in its focused entries on a wide variety of topics in neurology neurosurgery psychiatry and other related areas of neuroscience Each article is written by an expert in that specific domain and peer reviewed by the advisory board before acceptance into the encyclopedia Each article contains a glossary introduction a reference section and cross references to other related encyclopedia articles Written at a level suitable for university undergraduates the breadth and depth of coverage will appeal beyond undergraduates to professionals and academics in related fields **The Mammalian**

Auditory Pathway: Neurophysiology Richard R. Fay, 2013-12-01 The Springer Handbook of Auditory Research presents a series of comprehensive and synthetic reviews of the fundamental topics in modern auditory research It is aimed at all individuals with interests in hearing research including advanced graduate students postdoctoral researchers and clinical investigators The volumes will introduce new investigators to important aspects of hearing science and will help established investigators to better understand the fundamental theories and data in fields of hearing that they may not normally follow closely Each volume is intended to present a particular topic comprehensively and each chapter will serve as a synthetic overview and guide to the literature As such the chapters present neither exhaustive data reviews nor original research that has not yet appeared in peer reviewed journals The series focusses on topics that have developed a solid data and conceptual foundation rather than on those for which a literature is only beginning to develop New research areas will be covered on a timely basis in the series as they begin to mature **Basic and Applied Aspects of Noise-Induced Hearing**

Loss Richard J. Salvi, D. Henderson, R. P. Hamernik, V. Colletti, 2013-03-09 In September 1985 NATO sponsored an Advanced Study Workshop entitled Noise Induced Hearing Loss Basic and Applied Aspects The meeting was held in a mountain retreat near Lucca Italy and was attended by scientists clinicians and public officials from 12 countries This was the third in a series of such conferences organized by the authors The first two were supported by the United States National Institute of Occupational Safety and Health their proceedings were published as The Effects of Noise on Hearing in 1976 and New Perspectives on Noise Induced Hearing Loss in 1982 The Organizing Committee approached NATO because it was felt that the problem of noise was common to all industrialized countries and was an especially serious problem for the military Thus the NATO sponsorship and the Italian site of the meeting were part of the Organizing Committee's plan to obtain an international and thorough representation on the problem of noise induced hearing loss The NATO meeting and proceedings followed the format of the previous two symposia with an initial focus on the anatomical and physiological disturbances resulting from noise induced hearing loss This was followed by sections devoted to studies of a more applied nature involving general auditory performance in noise issues associated with the establishment of noise exposure criteria nonauditory effects of noise and the interaction of noise with other agents *The Mammalian Auditory Pathway: Neuroanatomy* Douglas B

Webster, Richard R. Fay, 2013-12-01 The Springer Handbook of Auditory Research presents a series of comprehensive and synthetic reviews of the fundamental topics in modern auditory research. It is aimed at all individuals with interests in hearing research including advanced graduate students, postdoctoral researchers and clinical investigators. The volumes will introduce new investigators to important aspects of hearing science and will help established investigators to better understand the fundamental theories and data in fields of hearing that they may not normally follow closely. Each volume is intended to present a particular topic comprehensively and each chapter will serve as a synthetic overview and guide to the literature. As such, the chapters present neither exhaustive data reviews nor original research that has not yet appeared in peer-reviewed journals. The series focusses on topics that have developed a solid data and conceptual foundation rather than on those for which a literature is only beginning to develop. New research areas will be covered on a timely basis in the series as they begin to mature.

The Oxford Handbook of Universal Grammar Ian Roberts, 2016-12-22 This handbook provides a critical guide to the most central proposition in modern linguistics, the notion generally known as Universal Grammar, that a universal set of structural principles underlies the grammatical diversity of the world's languages. Part I considers the implications of Universal Grammar for philosophy of mind and philosophy of language and examines the history of the theory. Part II focuses on linguistic theory, looking at topics such as explanatory adequacy and how phonology and semantics fit into Universal Grammar. Parts III and IV look respectively at the insights derived from UG-inspired research on language acquisition and at comparative syntax and language typology, while part V considers the evidence for Universal Grammar in phenomena such as creoles, language pathology and sign language. The book will be a vital reference for linguists, philosophers and cognitive scientists.

Rodent Bioacoustics Micheal L. Dent, Richard R. Fay, Arthur N. Popper, 2018-08-28 By far the most widely used subjects in psychological and biological research today are rodents. Although rats and mice comprise the largest group of animals used in research, there are over 2,000 species and 27 families of rodents living all over the world except Antarctica and thriving in many different habitat types. The vast environmental diversity that rodents face has led to numerous adaptations for communication, including vocalizing and hearing in both the sonic and ultrasonic ranges, effectively communicating in the open air and underground and using vocalizations for coordinating sexual behavior, for mother-pup interactions and for signaling an alarming situation to the group. Some rodent species have even developed foot drumming behaviors for communication. Comparative studies from around the globe using both field and laboratory methodologies reveal the vast differences in acoustic communication behavior across many rodent species. Some rodents are amenable to training and have been domesticated and bred purely for research purposes. Since the early 1900s, rats and mice have been indispensable to research programs around the world. Thus, much of what we know about hearing and vocalizations in rodents comes from these two species tested in the laboratory. The sequencing of the mouse genome in 2002 followed by the rat genome in 2004 only increased the utility of these animals as research subjects since genetically

engineered strains mimicking human diseases and disorders could be developed more easily In the laboratory rats and mice are used as models for human communication and hearing disorders and are involved in studies on hearing loss and prevention hormones and auditory plasticity to name a few We know that certain strains of mice retain hearing better than others throughout their lifespan and about the genes involved in those differences We know about the effects of noise hormones sex aging and circadian rhythms on hearing in mice and other rodents We also know about normal hearing in many families of rodents including the perception of simple and complex stimuli and the anatomy and physiology of hearing and sound localization The importance of acoustic communication to these animals as well as the significance of these mammals to biomedical research are summarized in the chapters *Bat Bioacoustics* M. Brock Fenton, Alan D. Grinnell, Arthur N. Popper, Richard R. Fay, 2016-06-02 Arguably biosonar is one of the eye opening discoveries about animal behavior and the auditory systems of echolocators are front and center in this story Echolocation by bats has proven to be a virtual gold mine for colleagues studying neurobiology while providing many rich examples of its impact on other areas of bats lives In this volume we briefly review the history of the topic reminding readers of the 1995 *Hearing by Bats* We use a chapter on new findings in the phylogeny of bats to put the information that follows in an evolutionary context This includes an examination of the possible roles of Prestin and FoxP2 genes and various anatomical features affecting bat vocalizations We introduce recent work on the role of noseleaves ears and other facial components on the focusing of sound and collection of echoes

Auditory System H. W. Ades, A. Axelsson, I. L. Baird, G. v. Békésy, R. L. Boord, C. B. G. Campbell, O. Densert, D. H. Eldredge, H. Engström, J. Fex, J. M. Harrison, O. W. Henson, M. E. Howe, S. Iurato, A. Michelsen, A. R. Møller, R. R. Pfeiffer, S. Rauch, I. Rauch, E. A. G. Shaw, J. Wersäll, E. G. Wever, 2012-12-06 In planning *The Handbook* volumes on Audition we the editors made the decision that there should be many authors each writing about the work in the field that he knew best through his own research rather than a few authors who would review areas of research with which they lacked first hand familiarity For the purposes of the chapters on Audition sensory physiology has been defined very broadly to include studies from the many disciplines that contribute to our understanding of the structures concerned with hearing and the processes that take place in these structures in man and in lower animals A number of chapters on special topics have been included in order to present information that might not be covered by the usual chapters dealing with anatomical physiological and behavioral aspects of hearing We wish to thank all authors of the volumes on Audition for the contributions that they have made We feel confident that their efforts will also be appreciated by the many scientists and clinicians who will make use of the Handbook for many years to come WOLF D KEIDEL WILLIAM D NEFF Erlangen Bloomington August 1974 Contents Introduction By G v BEKESY t With 3 Figures 1 Chapter 1 Consideration of the Acoustic Stimulus By R R PFEIFFER With Chapter 2 19 Figures 9 Comparative Anatomy of the Middle Ear By O W HENSON Jr With Chapter 3 23 Figures 39

Tinnitus Jos J. Eggermont, Fan-Gang Zeng, Arthur N. Popper, Richard R. Fay, 2012-07-06 Tinnitus is a prevalent hearing

disease affecting 15% of the population particularly hearing impaired veterans and even young people who grow up with mp3 players and iPods The mechanisms underlying tinnitus remain controversial At present there is no cure for tinnitus and treatment options are limited Different from previous tinnitus books including A R Moller s book in press at Springer which typically have a strong clinical flavor the present volume focuses on neural mechanisms of tinnitus and its behavioral consequences The proposed book starts with a general summary of the field and a short introduction on the selection and content of the remaining chapters Chapter 2 overviews tinnitus prevalence and etiologies to set the tone for significance and complexity of this neurological disorder spectrum Chapters 3 8 cover neuroscience of tinnitus in animal models from molecular mechanisms to cortical manifestation Chapters 9 12 cover human brain responses to tinnitus and its clinical management

Timbre: Acoustics, Perception, and Cognition Kai Siedenburg, Charalampos Saitis, Stephen McAdams, Arthur N. Popper, Richard R. Fay, 2019-05-07 Roughly defined as any property other than pitch duration and loudness that allows two sounds to be distinguished timbre is a foundational aspect of hearing The remarkable ability of humans to recognize sound sources and events e g glass breaking a friend s voice a tone from a piano stems primarily from a capacity to perceive and process differences in the timbre of sounds Timbre raises many important issues in psychology and the cognitive sciences musical acoustics speech processing medical engineering and artificial intelligence Current research on timbre perception unfolds along three main fronts On the one hand researchers explore the principal perceptual processes that orchestrate timbre processing such as the structure of its perceptual representation sound categorization and recognition memory for timbre and its ability to elicit rich semantic associations as well as the underlying neural mechanisms On the other hand timbre is studied as part of specific scenarios including the perception of the human voice as a structuring force in music as perceived with cochlear implants and through its role in affecting sound quality and sound design Finally computational acoustic models are sought through prediction of psychophysical data physiologically inspired representations and audio analysis synthesis techniques Along these three scientific fronts significant breakthroughs have been achieved during the last decade This volume will be the first book dedicated to a comprehensive and authoritative presentation of timbre perception and cognition research and the acoustic modeling of timbre The volume will serve as a natural complement to the SHAR volumes on the basic auditory parameters of Pitch edited by Plack Oxenham Popper and Fay and Loudness by Florentine Popper and Fay Moreover through the integration of complementary scientific methods ranging from signal processing to brain imaging the book has the potential to leverage new interdisciplinary synergies in hearing science For these reasons the volume will be exceptionally valuable to various subfields of hearing science including cognitive auditory neuroscience psychoacoustics music perception and cognition but may even exert significant influence on fields such as musical acoustics music information retrieval and acoustic signal processing It is expected that the volume will have broad appeal to psychologists neuroscientists and acousticians involved in research on auditory perception and cognition

Specifically this book will have a strong impact on hearing researchers with interest in timbre and will serve as the key publication and up to date reference on timbre for graduate students postdoctoral researchers as well as established scholars

Multisensory Processes Adrian K. C. Lee, Mark T. Wallace, Allison B. Coffin, Arthur N. Popper, Richard R. Fay, 2019-03-08 Auditory behavior perception and cognition are all shaped by information from other sensory systems This volume examines this multi sensory view of auditory function at levels of analysis ranging from the single neuron to neuroimaging in human clinical populations Visual Influence on Auditory Perception Adrian K C Lee and Mark T Wallace Cue Combination within a Bayesian Framework David Alais and David Burr Toward a Model of Auditory Visual Speech Intelligibility Ken W Grant and Joshua G W Bernstein An Object based Interpretation of Audiovisual Processing Adrian K C Lee Ross K Maddox and Jennifer K Bizley Hearing in a Moving Visual World Coordinate Transformations Along the Auditory Pathway Shawn M Willett Jennifer M Groh Ross K Maddox Multisensory Processing in the Auditory Cortex Andrew J King Amy Hammond Kenny Fernando R Nodal Audiovisual Integration in the Primate Prefrontal Cortex Bethany Plakke and Elizabeth M Romanski Using Multisensory Integration to Understand Human Auditory Cortex Michael S Beauchamp Combining Voice and Face Content in the Primate Temporal Lobe Catherine Perrodin and Christopher I Petkov Neural Network Dynamics and Audiovisual Integration Julian Keil and Daniel Senkowski Cross Modal Learning in the Auditory System Patrick Bruns and Brigitte R der Multisensory Processing Differences in Individuals with Autism Spectrum Disorder Sarah H Baum Miller Mark T Wallace Adrian K C Lee is Associate Professor in the Department of Speech Hearing Sciences and the Institute for Learning and Brain Sciences at the University of Washington Seattle Mark T Wallace is the Louise BMcGavock Endowed Chair and Professor in the Departments of Hearing and Speech Sciences Psychiatry Psychology and Director of the Vanderbilt Brain Institute at Vanderbilt University Nashville Allison B Coffin is Associate Professor in the Department of Integrative Physiology and Neuroscience at Washington State University Vancouver WA Arthur N Popper is Professor Emeritus and research professor in the Department of Biology at the University of Maryland College Park Richard R Fay is Distinguished Research Professor of Psychology at Loyola University Chicago Understanding the Cochlea Geoffrey A. Manley, Anthony W. Gummer, Arthur N. Popper, Richard R. Fay, 2017-08-30 This SHAR volume serves to expand supplement and update the original Cochlea volume in the series The book aims to highlight the power of diverse modern approaches in cochlear research by focusing on advances in those fields over the last two decades It also provides insights into where cochlear research is going including new hearing prostheses for the deaf that will most likely soon enter the phase of clinical trials The book will appeal to a broad interdisciplinary readership including neuroscientists and clinicians in addition to the more specific auditory community **The Lateral Line System** Sheryl Coombs, Horst Bleckmann, Richard R. Fay, Arthur N. Popper, 2013-10-23 The Lateral Line System provides an overview of the key concepts and issues surrounding the development evolution neurobiology and function of the lateral line a fascinating yet somewhat enigmatic flow sensing system The book examines the historical precedence for

linking the auditory and lateral line systems its structure and development use of the lateral line system of zebrafish as a model system physical principles governing the response properties of the lateral line the behavioral relevance of this sensory system to the lives of fish and an examination of how this information is shaped and encoded by the peripheral and central nervous systems Contents The Gems of the Past A Brief History of Lateral Line Research in the Context of the Hearing Sciences Sheryl Coombs and Horst Bleckmann Morphological Diversity Development and Evolution of the Mechanosensory Lateral Line System Jacqueline F Webb The Hydrodynamic of Flow Stimuli Matthew J McHenry and James C Liao The Biophysics of the Fish Lateral Line Sietse M van Netten and Matthew J McHenry Sensory Ecology and Neuroethology of the Lateral Line John Montgomery Horst Bleckmann and Sheryl Coombs Information Encoding and Processing by the Peripheral Lateral Line System Boris Philippe Chagnaud and Sheryl Coombs The Central Nervous Organization of the Lateral Line System Mario F Wullimann and Benedikt Grothe Central Processing of Lateral Line Information Horst Bleckmann and Joachim Mogdans Functional Overlap and Nonoverlap Between Lateral Line and Auditory Systems Christopher B Braun and Olav Sand The Hearing Loss Protection and Regeneration in the Larval Zebrafish Lateral Line Allison B Coffin Heather Brignull David W Raible and Edwin W Rubel **The Cochlea** Peter Dallos, Richard R. Fay, 2012-12-06 Knowledge about the structure and function of the inner ear is vital to an understanding of vertebrate hearing This volume presents a detailed overview of the mammalian cochlea from its anatomy and physiology to its biophysics and biochemistry The nine review chapters written by internationally distinguished auditory researchers provide a detailed and unified introduction to sound processing in the cochlea and the steps by which the ensuing signals are prepared for the central nervous system **Music Perception** Mari Riess Jones, Richard R. Fay, Arthur N. Popper, 2010-08-17 The Springer Handbook of Auditory Research presents a series of comprehensive and synthetic reviews of the fundamental topics in modern auditory research The volumes are aimed at all individuals with interests in hearing research including advanced graduate students post doctoral researchers and clinical investigators The volumes are intended to introduce new investigators to important aspects of hearing science and to help established investigators to better understand the fundamental theories and data in fields of hearing that they may not normally follow closely Each volume presents a particular topic comprehensively and each serves as a synthetic overview and guide to the literature As such the chapters present neither exhaustive data reviews nor original research that has not yet appeared in peer reviewed journals The volumes focus on topics that have developed a solid data and conceptual foundation rather than on those for which a literature is only beginning to develop New research areas will be covered on a timely basis in the series as they begin to mature

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