The Neurobiology Of Saccadic Eye Movements

#neurobiology of saccades #saccadic eye movement control #neural mechanisms eye movement #brain oculomotor system #rapid eye movements science

Delve into the fascinating neurobiology of saccadic eye movements, exploring the intricate neural mechanisms and brain oculomotor system that orchestrate these incredibly rapid eye movements. This field investigates how the brain generates and controls the swift, jerky eye movements essential for shifting our gaze and enabling efficient visual perception and attention. Understanding the saccadic eye movement control provides insight into fundamental aspects of neurological function.

The Neurobiology of Saccadic Eye Movements

Saccadic eye movements shift the direction of the eye rapidly from one part of the visual field to another. The system within the brain controlling this eye movement is probably the best understood sensory motor system in the brain of primates. The Neurobiology of Saccadic Eye Movements presents a series of state-of-the-art reviews of this system including the behavior, neuronal mechanisms, and systems engineering characterization. The successful interaction of systems modelling with the neurophysiological approaches described in this book provide a potential blueprint for future study of more complicated systems within the brain.

Visual and Oculomotor Functions

A collection of contemporary work in various areas of eye-movement research with an emphasis on physiological aspects is presented in this book. The contributions are divided into six sections: I. saccadic eye movements; II. smooth pursuit and motion perception; III. eye movements in pathology and clinical settings; IV. neurophysiology of eye movements; V. optokinetic nystagmus; and VI. methods. This volume provides updated information on the most recent research on eye movements carried out mainly in Europe.

The Neurology of Eye Movements : Text and CD-ROM

The Neurology of Eye Movements provides clinicians with a synthesis of current scientific information that can be applied to the diagnosis and treatment of disorders of ocular motility. Basic scientists will also benefit from descriptions of how data from anatomical, electrophysiological, pharmacological, and imaging studies can be directly applied to the study of disease. By critically reviewing such basic

studies, the authors build a conceptual framework that can be applied to the interpretation of abnormal ocular motor behavior at the bedside. These syntheses are summarized in displays, new figures, schematics and tables. Early chapters discuss the visual need and neural basis for each functional class of eye movements. Two large chapters deal with the evaluation of double vision and systematically evaluate how many disorders of the central nervous system affect eye movements. This edition has been extensively rewritten, and contains many new figures and an up-to-date section on the treatment of abnormal eye movements such as nystagmus. A major innovation has been the development of an option to read the book from a compact disc, make use of hypertext links (which bridge basic science to clinical issues), and view the major disorders of eye movements in over 60 video clips. This volume will provide pertinent, up-to-date information to neurologists, neuroscientists, ophthalmologists, visual scientists, otalaryngologists, optometrists, biomedical engineers, and psychologists.

The Neurology of Eye Movements

"It is a tremendous achievement to have provided this highly comprehensive but readable text, which informs such a large group of researchers and clinicians." Christopher Kennard, PhD, FRCP, FMedSci, Professor of Clinical Neurology, Head, Nuffield Department of Clinical Neurosciences, University of Oxford, John Radcliffe Hospital, Oxford, United Kingdom. "A monograph written with deep knowledge, understanding, wisdom, clarity, intelligibility - the superlatives could go on and on... A remarkable achievement and a great gift to all of us from the two modern giants of eye movement disorders." Michael Halmagyi, MD, Eye and Ear Research Unit, Neurology Department, Royal Prince Alfred Hospital, The University of Sydney, Australia. "The fifth edition of The Neurology of Eye Movements is a must for all neurologists and neuroscientists interested in how the human vestibular and oculomotor systems adapt to movement in space and to optimally viewing the world and its contents." Louis R. Caplan, MD, Department of Neurology, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, Massachusetts.

Eye Movements

Eye-movement recording has become the method of choice in a wide variety of disciplines investigating how the mind and brain work. This volume brings together recent, high-quality eye-movement research from many different disciplines and, in doing so, presents a comprehensive overview of the state-of-the-art in eye-movement research. Sections include the history of eye-movement research, physiological and clinical studies of eye movements, transsaccadic integration, computational modelling of eye movements, reading, spoken language processing, attention and scene perception, and eye-movements in natural environments. Includes recent research from a variety of disciplines Divided into sections based on topic areas, with an overview chapter beginning each section Through the study of eye movements we can learn about the human mind, and eye movement recording has become the method of choice in many disciplines

The Oxford Handbook of Eye Movements

In the past few years, there has been an explosion of eye movement research in cognitive science and neuroscience. The Oxford Handbook of Eye Movements provides the first comprehensive review of the entire field of eye movement research. This book is the definitive reference work in this field.

Current Oculomotor Research

This volume contains the proceedings of the Ninth European Conference on Eye Movements (ECEM 9), held in Ulm, Germany, on September 23-26, 1997. ECEM 9 con tinued a series of conferences initiated by Rudolf Groner of Bern, Switzerland, in 1981 which, from its very beginning, has brought together scientists from very diverse fields with a common interest in eye movements. About 40 of the papers presented at ECEM 9 have been selected for presentation in full length while others are rendered in condensed form. There is a broad spectrum of motives why people have become involved in, and fas cinated by, eye movement research. Neuroscientists have been allured by the prospect of understanding anatomical findings, single unit recordings, and the sequels of experimental lesions in terms of the clearly defined system requirements and the well documented be havioural repertoire of the oculomotor system. Others have been attracted by the richness of this repertoire and its dependence on an intricate hierarchy of factors spanning from "simple" reflexes to visual pattern recognition and spatio-temporal prediction. Neurolo gists, neuro-ophthalmologists and neuro-otologists have long standing experience with eye movements as sensitive indicators of lesions in the brain stem,

the midbrain, and the cere bellum. By studying oculomotor malfunctions they have made, and are continuing to make, important contributions to our understanding of oculomotor functions.

Eye Movement Research

This edited volume presents fundamentals as well as applications of oculomotor methods in industrial and clinical settings. The topical spectrum covers 1.) basics and background material, 2.) methods such as recording techniques, markov models, Lévy flights, pupillometry and many more, as well as 3.) a broad range of applications in clinical and industrial settings. The target audience primarily comprises research experts and practitioners, but the book may also be beneficial for graduate students.

The Superior Colliculus

The Superior Colliculus: New Approaches for Studying Sensorimotor Integration discusses new experimental and theoretical approaches to investigating how the brain transforms sensory signals into the motor commands that are used to shift the direction of gaze. The material includes the potential models for sensorimotor integration in the primate bra

The Mind's Eye

The book provides a comprehensive state-of-the-art overview of current research on cognitive and applied aspects of eye movements. The contents include peer-reviewed chapters based on a selection of papers presented at the 11th European Conference on Eye Movements (Turku, Finland 2001), supplemented by invited contributions. The ECEM conference series brings together researchers from various disciplines with an interest to use eye-tracking to study perceptual and higher order cognitive functions. The contents of the book faithfully reflect the scope and diversity of interest in eye-tracking as a fruitful tool both in basic and applied research. It consists of five sections: visual information processing and saccadic eye movements; empirical studies of reading and language production; computational models of eye movements in reading; eye-tracking as a tool to study human-computer interaction; and eye movement applications in media and communication research. Each section is concluded by a commentary chapter by one of the leading authorities in the field. These commentaries discuss and integrate the contributions in the section and provide an expert view on the most significant present and future developments in the respective areas. The book is a reference volume including a large body of new empirical work but also principal theoretical viewpoints of leading research groups in the field.

Oculomotor Control and Cognitive Processes

This volume contains selected and edited papers from the fifth European Conference on Eye Movements (ECEM 5) held at the University of Pavia, Italy on September 10-13, 1989. The volume is organized in six sections as follows: Neurophysiology of Eye Movements; Control of Eye Movements; Eye-Head Coordination; Eye Movements in Pathology; Eye Movements and Cognitive Processes and Applied Research. The last section also contains some papers derived from the satellite symposium on Visual Processes and Eye Movements in Dyslexia, which was organized by the Roding Remediation Foundation.

The Brain and Regulation of Eye Movement

Dr. Shakhnovich brought out the original Russian edition of this work in 1974. Fully half of that book was concerned with his own studies of eye movements. These included observations on patients with neuromuscular disorders that produced unique oculomotor deficits. Other anomalies of eye motility resulted from local changes in cerebral and cerebellar blood flow and the effects of surgical intervention for aneurisms and brain tumors. Supplementary experi ments included the probing of single units in the motor and visual brain areas of rabbits. Still other studies were done on normal human eye movements with the aid of the Yarbus "cap" attachment to the cornea of the eye. A major aim of the original book was to show that eye movements provide a relatively simple illustration of "goal-directed behavior." This traditional Russian theme, developed by Sechenov, Pavlov, and Bemshtein, was put forth as a unifying concept to explain the author's findings. Consideration was also given to Western ideas ana problems that dominated the research of the 1950's and 1960's. Among these, as summarized by Dr. Shakhnovich, were perceptual constancy, corollary discharge, saccadic suppression, and the effects of image stabilization.

David A. Robinson’s Modeling the Oculomotor Control System

Modelling: The Oculomotor Systems, Volume 269 in the Progress in Brain Research serial highlights new advances in the field with this new volume presenting interesting chapters on topics including The function and phylogeny of eye movements, The behavior of motoneurons, Statics of plant mechanics, Dynamics of plant mechanics, The functional operation of the vestibulo-ocular reflex, Basic framework of the vestibulo-ocular reflex, Oculomotor signals, Signal processing in the vestibulo-ocular reflex, Plasticity and repair of the vestibulo-ocular reflex, The behavior of the optokinetic system, Models of the optokinetic system, Neurophysiology of the optokinetic system, and much more. Provides the authority and expertise of leading contributors from an international board of authors Presents the latest release in Progress in Brain Research serial Includes the latest information on Modelling: The Oculomotor Systems

Eye Movement Research

This volume contains selected and edited papers from the 7th European Conference on Eye Movements (ECEM 7) held in Durham, UK on August 31-September 3 1993. The volume is organized as follows:- Invited Lectures, Pursuit and Co-Ordination, Saccade and Fixation Control, Oculomotor Physiology, Clinical and Medical Aspects of Eye Movements, Eye Movements and Cognition, Eye Movements and Language and finally, Displays and Applications.

Active Vision

This title focuses on vision as an active process, rather than a passive activity and provides an integrated account of seeing and looking. The authors give a thorough description of basic details of the visual and oculomotor systems necessary to understand active vision.

Models of Horizontal Eye Movements

There are five different types of eye movements: saccades, smooth pursuit, vestibular ocular eye movements, optokinetic eye movements, and vergence eye movements. The purpose of this book series is focused primarily on mathematical models of the horizontal saccadic eye movement system and the smooth pursuit system, rather than on how visual information is processed. A saccade is a fast eye movement used to acquire a target by placing the image of the target on the fovea. Smooth pursuit is a slow eye movement used to track a target as it moves by keeping the target on the fovea. The vestibular ocular movement is used to keep the eyes on a target during brief head movements. The optokinetic eye movement is a combination of saccadic and slow eye movements that keeps a full-field image stable on the retina during sustained head rotation. Each of these movements is a conjugate eye movement, that is, movements of both eyes together driven by a common neural source. A vergence movement is a non-conjugate eye movement allowing the eyes to track targets as they come closer or farther away. In Part 1, early models of saccades and smooth pursuit are presented. A number of oculomotor plant models are described therein beginning with the Westheimer model published in 1954, and up through our 1995 model involving a 4th-order oculomotor plant model. In Part 2, a 2009 version of a state-of-the-art model is presented for horizontal saccades that is 3rd-order and linear, and controlled by a physiologically based time-optimal neural network. In this book, a multiscale model of the saccade system is presented, focusing on the neural network. Chapter 1 summarizes a whole muscle model of the oculomotor plant based on the 2009 3rd-order and linear, and controlled by a physiologically based time-optimal neural network. Chapter 2 presents a neural network model of biophysical neurons in the midbrain for controlling oculomotor muscles during horizontal human saccades. To investigate horizontal saccade dynamics, a neural circuitry, including omnipause neuron, premotor excitatory and inhibitory burst neurons, long lead burst neuron, tonic neuron, interneuron, abducens nucleus, and oculomotor nucleus, is developed. A generic neuron model serves as the basis to match the characteristics of each type of neuron in the neural network. We wish to express our thanks to William Pruehsner for drawing many of the illustrations in this book. Table of Contents: Acknowledgments / 2009 Linear Homeomorphic Saccadic Eye Movement Model / A Neuron-Based Time-Optimal Controller of Horizontal Saccadic Eye Movements and Glissades / References / Authors' Biographies

Physiological and Pathological Aspects of Eye Movements

This volume contains the proceedings of a work shop entitled "Physiological and Pathological Aspects of Eye Movements" held at the Pont d'Oye Castle, Habay-Ia-Neuve, Belgium, March 27-30 1982. The meeting was sponsored by the European Communi ties. It brought together specialists of ocu-

lomotricity mainly from Europe but also from North-America. With such actions, the Communities want to encourage inter national and multidisciplinary contacts between re searchers of a particular field. Oculomotor neuroscien tists, for quite a long time, have developed such con tacts. This cooperation - this is not so common in biological research - embodies various approaches, from basic mechanisms to behavioral studies, but also this applied science that medicine is or should be. Many basic discoveries about eye movement mechanisms, made with the help of human of animal subjects, have found rapid medical applications in neurology, neuro ophthalmology or otolaryngology. This is illustrated in this book by the fact that results obtained on rats or cats are interspersed with reports of clinical in vestigations. The workshop was mainly focused onto three themes: (a) eye and head movements in man, (b) visuo-vestibular interaction and (c) eye-head coordination. In each theme, one or more "review" papers were included. In addition, most of the oral presentations or posters on display mainly contained unpublished material.

Eye Movements and Psychological Processes

In the 10 years prior to publication the quantity of research on eye movements as they pertain to psychological processes had been increasing at a rapid rate. Originally published in 1976, the editors' purpose was to bring together investigators representing different theoretical positions and methodological approaches to present their recent findings, to debate the theoretical points of view, and to identify and discuss the major research problems on eye movements at the time. An attempt was made to invite participants ranging all the way from promising graduate students through the established authorities in the field. The result was an intensive three-day session with meetings from early morning until late into the evening with much opportunity for formal and informal group discussion. The edited papers and transcripts of the discussions are the contents of this book.

Advances in Translational Neuroscience of Eye Movement Disorders

A comprehensive book that reviews advances in ocular motor research on topics of general interest, rare, specialized or unique conditions, and pertinent basic neuroscience. A rare collection with contributions from basic neuroscientists, neurologists, and ophthalmologists. Includes dedicated chapters on mathematical models, pharmacotherapy, neuromodulation, motion perception, visual influence on eye movement, physiology of strabismus, and microsaccades. This book is dedicated to David Robinson - one of the pioneers of contemporary ocular motor and vestibular neuroscience.

Neuro-ophthalmology

All motor behavior is characterized by sensory inputs causing specific motor reactions. Because humans modify motor reactions voluntarily or through experience, this input-output relation is more complex in humans than in lower vertebrates. Eye movements provide a window on fundamental brain function, not only for topographic diagnosis of dysfunctions but also for the comprehension of normal brain function. This book highlights basic mechanical properties of eye movements, explains the neuronal basis of the vestibular-ocular reflex, saccadic eye movements, smooth-pursuit eye movements, and vergence eye movements, and deals with their pharmacological manipulation in disorders. Since precise measurement of motor reactions is essential for understanding the oculomotor system, one chapter critically discusses current registration methods, and another one considers the possibilities and limitations of modeling it by control theory methods. Its comprehensive characterization of eye movements and their relation to brain function makes this publication essential reading to ophthalmologists, neurologists, and clinical neuropsychologists.

The Moving Tablet of the Eye

Eye movements are a vital part of our interaction with the world. They play a pivotal role in perception, cognition, and education. Research in this field is now proceeding at a considerable pace and casting new light on how the eyes move and what information we can derive during the frequentand brief periods of fixation. However, the origins of this work are less well known, even though much of our knowledge was derived from this research with far more primitive equipment. This book is unique in tracing the history of eye movement research. It shows how great strides were made in this area before modern recording devices were available, especially in the measurement of nystagmus. When photographic techniques were adapted to measure discontinuous eye movements, fromabout 1900, many of the issues that are now basic to modern research were then investigated. One of the earliest cognitive tasks examined was reading, and it remains in the vanguard of contemporary research.

Modern researchers in this field will be astonished at the subtleties of these early experimental studies and the ingenuity of interpretations that were advanced one and even two centuries ago. Though physicians often carried out the original eye movement research, later on it was pursued bypsychologists - it is within contemporary neuroscience that we find these two strands reunited. Anyone interested in the origins of psychology and neuroscience will find much to stimulate and surprise them in this valuable new work.

Models of Horizontal Eye Movements

There are five different types of eye movements: saccades, smooth pursuit, vestibular ocular eye movements, optokinetic eye movements, and vergence eye movements. The purpose of this book is focused primarily on mathematical models of the horizontal saccadic eye movement system and the smooth pursuit system, rather than on how visual information is processed. A saccade is a fast eye movement used to acquire a target by placing the image of the target on the fovea. Smooth pursuit is a slow eye movement used to track a target as it moves by keeping the target on the fovea. The vestibular ocular movement is used to keep the eyes on a target during brief head movements. The optokinetic eye movement is a combination of saccadic and slow eye movements that keeps a full-field image stable on the retina during sustained head rotation. Each of these movements is a conjugate eye movement, that is, movements of both eyes together driven by a common neural source. A vergence movement is a non-conjugate eye movement allowing the eyes to track targets as they come closer or farther away. In this book, early models of saccades and smooth pursuit are presented. The smooth pursuit system allows tracking of a slow moving target to maintain its position on the fovea. Models of the smooth pursuit have been developed using systems control theory, all involving a negative feedback control system that includes a time delay, controller and plant in the forward loop, with unity feedback. The oculomotor plant and saccade generator are the basic elements of the saccadic system. The oculomotor plant consists of three muscle pairs and the eyeball. A number of oculomotor plant models are described here beginning with the Westheimer model published in 1954, and up through our 1995 model involving a 4th order oculomotor plant model. The work presented here is not an exhaustive coverage of the field, but focused on the interests of the author. In Part II, a state-of-art model of the saccade system is presented, including a neural network that controls the system. Table of Contents: Introduction / Smooth Pursuit Models / Early Models of the Horizontal Saccadic Eye Movement System / Velocity and Acceleration Estimation / 1995 Linear Homeomorphic Saccadic Eye Movement Model

Using Eye Movements as an Experimental Probe of Brain Function

This volume of Progress in Brain Research is based on the proceedings of a conference, "Using Eye Movements as an Experimental Probe of Brain Function," held at the Charing Cross Hospital Campus of Imperial College London, UK on 5th -6th December, 2007 to honor Professor Jean Büttner-Ennever. With 87 contributions from international experts – both basic scientists and clinicians – the volume provides many examples of how eye movements can be used to address a broad range of research questions. Section 1 focuses on extraocular muscle, highlighting new concepts of proprioceptive control that involve even the cerebral cortex. Section 2 comprises structural, physiological, pharmacological, and computational aspects of brainstem mechanisms, and illustrates implications for disorders as diverse as opsoclonus, and congenital scoliosis with gaze palsy. Section 3 addresses how the cerebellum transforms neural signals into motor commands, and how disease of such mechanisms may lead to ataxia and disorders such as oculopalatal tremor. Section 4 deals with sensory-motor processing of visual, vestibular, somatosensory, and auditory inputs, such as are required for navigation, and gait. Section 5 illustrates how eye movements, used in conjunction with single-unit electrophysiology, functional imaging, transcranial magnetic stimulation, and lesion studies have illuminated cognitive processes, including memory, prediction, and even free will. Section 6 includes 18 papers dealing with disorders ranging from congenital to acquired forms of nystagmus, genetic and degenerative neurological disorders, and treatments for nystagmus and motion sickness. * Clinicians will find important new information on the substrate for spinocerebellar ataxia, late-onset Tay-Sachs disease, Huntington disease, and pulvinar lesions * Organizes multiple articles on such topics as proprioception, short and longer-term memory, and hereditary cerebellar ataxias for a more coherent presentation * Articles on anatomic tracers, functional imaging, and computational neuroscience are illustrated in color

Models of Horizontal Eye Movements

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The Control of Eye Movements

The Control of Eye Movements presents the proceedings of the Symposium on the Control of Eye Movements organized by the Smith-Kettlewell Institute of Visual Sciences of the Pacific Medical Center and the Department of Visual Sciences of the University of the Pacific Graduate School of Medical Sciences, San Francisco, California, November 10-11, 1969. The book is organized into two parts. Part I is devoted to presentations of anatomical, physiological, pharmacological, psychological, and clinical aspects of eye movements. The material presented should provide a valuable reference source as well as increase awareness of the need for further investigation of many aspects of the basic physiology of eye movements. Part II presents a series of papers dealing with models of various parts of the oculomotor system. The modeling approach to control of eye movements is still in its infancy and the present work presents the first comprehensive survey of biophysical, mathematical, and engineering aspects of eye movement control.

Models of Horizontal Eye Movements, Part I

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image stable on the retina during sustained head rotation. Each of these movements is a conjugate eye movement, that is, movements of both eyes together driven by a common neural source. A vergence movement is a non-conjugate eye movement allowing the eyes to track targets as they come closer or farther away. In this book, early models of saccades and smooth pursuit are presented. The smooth pursuit system allows tracking of a slow moving target to maintain its position on the fovea. Models of the smooth pursuit have been developed using systems control theory, all involving a negative feedback control system that includes a time delay, controller and plant in the forward loop, with unity feedback. The oculomotor plant and saccade generator are the basic elements of the saccadic system. The oculomotor plant consists of three muscle pairs and the eyeball. A number of oculomotor plant models are described here beginning with the Westheimer model published in 1954, and up through our 1995 model involving a 4th order oculomotor plant model. The work presented here is not an exhaustive coverage of the field, but focused on the interests of the author. In Part II, a state-of-art model of the saccade system is presented, including a neural network that controls the system. Table of Contents: Introduction / Smooth Pursuit Models / Early Models of the Horizontal Saccadic Eye Movement System / Velocity and Acceleration Estimation / 1995 Linear Homeomorphic Saccadic Eye Movement Model

The Brain's Eye Neurobiological and Clinical Aspects of Oculomotor Research

First Published in 1988. The idea for this book arose from a desire to bring together relevant information from the fields of vision research, neuropsychology, neurology, and psychiatry. The selection of topics covered by N europsychology of Eye Movements conforms to the primary areas of inquiry that currently exist. Unlike the majority of other books on eye movements, which represent proceedings of meetings, this volume is com prised of a number of critical review s of the research literature.

Neuropsychology of Eye Movement

This volume explores the latest eye-tracking methodologies that help researchers understand the background, methods, and applications involved in these studies. The chapters in this book cover topics such as methods and models of eye-tracking in natural environments; natural gaze informatics (i.e., assisted wheelchair mobility); eye-tracking application to understand the visual control of locomotion; eye movement in neurological disorders; and eye movements in sports research and practice. In the Neuromethods series style, chapters include the kind of detail and key advice from the specialists needed to get successful results in your laboratory. Cutting-edge and practical, Eye Tracking: Background, Methods, and Applications is a valuable resource for experienced and novice researchers interested in learning more about this field and its future developments.

Eye Tracking

The goal of this book is to put together some of the main interdisciplinary aspects that play a role in visual attention and cognition. The book is aimed at researchers and students with interdisciplinary interest. In the first chapter a general discussion of the influential scanpath theory and its implications for human and robot vision is presented. Subsequently, four characteristic aspects of the general theme are dealt with in topical chapters, each of which presents some of the different viewpoints of the various disciplines involved. They cover neuropsychology, clinical neuroscience, modeling, and applications. Each of the chapters opens with a synopsis tying together the individual contributions.

Visual Attention and Cognition

Edited by a leading scholar in the field, Eye Movements and Visual Cognitionpresents an up-to-date overview of the topics relevant to understanding the relationship between eye movements and visual cognition, particularly in relation to scene perception and reading. Cognitive psychologists, neuropsychologists, educational psychologists, and reading specialists will find this volume to be an authoritative source of state-of-the art research in this rapidly expanding area of study.

Eye Movements and Visual Cognition

It has become a truism that the frozen optical diagram representation of vision is the worst possible picture of the way in which we visually interact with the environment. Even apart from our reaction to moving targets by pursuit movements, our visual behaviour can be said to be characterised by eye movements. We sample from our environment in a series of relatively brief fixations which move from one point to another in a series of extremely rapid jerks known as saccades. Many questions arising

from this characteristic of vision are explored within this volume, including the question of how our visual world maintains its perceptual stability despite the drastic changes in input associated with these eye movements.

The Role of Eye Movements in Perceptual Processes

The Oculomotor and Skeletalmotor Systems

The Oculomotor and Skeletalmotor Systems

Eye movement research from a range of disciplines is presented in this book. Contributions from all over the world examine theoretical and applied aspects of eye movements, including classical biocybernetic models, physiology, pathology, ocular exploration, reading, ergonomics/human factors, and microcomputer calibration techniques.

Eye Movements from Physiology to Cognition

The recording and analysis of electrical brain activity associated with eye movements has a history of several decades. While the early attempts were primarily focused on uncovering the brain mechanisms of eye movements, more recent approaches use eye movements as markers of the ongoing brain activity to investigate perceptual and cognitive processes. This recent approach of segmenting brain activity based on eye movement behavior has several important advantages. First, the eye movement system is closely related to cognitive functions such as perception, attention and memory. This is not surprising since eye movements provide the easiest and the most accurate way to extract information from our visual environment and the eye movement system largely determines what information is selected for further processing. The eye movement-based segmentation offers a great way to study brain activity in relation to these processes. Second, on the methodological level, eye movements constitute a natural marker to segment the ongoing brain activity. This overcomes the problem of introducing artificial markers such as ones for stimulus presentation or response execution that are typical for a lab-based research. This opens possibilities to study brain activity during self-paced perceptual and cognitive behavior under naturalistic conditions such as free exploration of scenes. Third, by relating eye movement behavior to the ongoing brain activity it is possible to see how perceptual and cognitive processes unfold in time, being able to predict how brain activity eventually leads to behavior. This research topic illustrates advantages of the combined recording and analysis of eye movements and neural signals such as EEG, local field potentials and fMRI for investigation of the brain processes in humans and animals. The contributions include research papers, methodology papers and reviews demonstrating conceptual and methodological achievements in this rapidly developing field.

Eye movement-related brain activity during perceptual and cognitive processing

Information Processing Underlying Gaze Control covers the proceedings of the Satellite Workshop to the 16th European Neuroscience Association. The book presents materials concerning the computational properties of neuronal circuits underlying gaze control. The book contains 44 papers, which are organized into seven sections. The first section deals with the morphology and physiology of extraocular motor nuclei. Section II tackles the anatomo-functional organization of the saccadic system, and Section III covers the vestibular and otolithic systems. Section IV discusses the optokinetic and smooth pursuit systems, while Section V talks about other sensory systems involved in the control of oculomotor function. Section VI covers the role of cerebellum in the genesis and control of eye movements, and Section VII tackles the coordination of eye, head, and body movements. The text will be of great use to researchers who have an interest in gaze control.

Information Processing Underlying Gaze Control

'Vision and the Visual System' offers students, teachers and researchers a rigorous, yet accessible account of how the brain analyses the visual scene. Schiller and Tehovnik describe key aspects of visual perception such as colour, motion, pattern and depth while explaining the relationship between eye movements and neural structures in the brain.

Vision and the Visual System

Neural Dynamics of Adaptive Sensory-Motor Control

Neural Dynamics of Adaptive Sensory-Motor Control

The 19th century pioneers of motor physiology - Helmholtz, Hering, Fick and others - used the mathematics of motion, known as kinematics, to describe the laws of human movement and to deduce the neural control principles underlying these laws. After long neglect - partly due to limitations in stimulation and recording techniques - the kinematic approach is now resurging, fortified with modern computers and electrophysiology. New developments in recording techniques, as well as an improved understanding of the complex control properties of three-dimensional movements, have led to a flood of new research in this area. The classical laws of Donders and Listing have been confirmed and generalized, and computer simulations of the neural control of three-dimensional movement have been developed and tested. In this book, some of the world's leading scientists of motor control discuss how the brain represents and tranforms the kinematic variables of movement. Background chapters explain the basic concepts - non-commutativity, redundancy and the classical laws - and their application to normal function and motor disorders, and shorter articles describe current research. The contributions are based on presentations at a symposium held in Tübingen in August 1995. The wide scope of the book should enable researchers to gain an overview of current research, but should also help newcomers tot he field to get a good understanding of the questions and problems involved in three-dimensional movement control.

Three-dimensional Kinematics of the Eye, Head and Limb Movements

Mathematical Modelling in Motor Neuroscience: State of the Art and Translation to the Clinic, Gaze Orienting Mechanisms and Disease, Volume 249, the latest release in the Progress in Brain Research series, highlights new advances in the field, with this new volume presenting interesting chapters on a variety of topics, including Sequential Bayesian updating, Maps and Sensorimotor Transformations for Eye-Head Gaze Shifts: Role of the Midbrain Superior Colliculus, Modeling Gaze Position-Dependent Opsoclonus, Eye Position-Dependent Opsoclonus in Mild Traumatic Brain Injury, Saccades in Parkinson's disease -- hypometric, slow, and maladaptive, Brainstem Neural Circuits for Fixation and Generation of Saccadic Eye Movements, and much more. Provides the authority and expertise of leading contributors from an international board of authors Presents the latest release in the Progress in Brain Research series Includes the latest information on mathematical modeling in motor neuroscience

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