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Research in the Sensorimotor Control and Learning Lab (SCiLL) uses state-of-the-art neuroimaging and non-invasive brain stimulation tools to understand the brain-behaviour relationship. Skilled motor actions can seem effortless.

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Sensorimotor control is the emergent property that describes the interaction between sensory-perceptual (e.g. visual, haptic) and coordinative (e.g. motor planning) processes required to...

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Currently, the field has primarily investigated motor deficits and motor learning with limited consideration of the role of sensory information, even though it is recognized that integration of sensory information is a critical component of motor control (Borich et al., 2015; Bolognini et al., 2016). Furthermore, evidence has shown that sensory input is important for recovery after stroke.

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One of the more important facets of modern robotics is the notion of integrating the sensory perceptions experienced by an agent with its motoric capabilities—the actions it can perform—to...

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The major role of facial MI is in the initiation, control, and execution of orofacial movements, but it also may contribute to the learning of new motor skills and the adaptation to altered sensory inputs, such as might occur with changes to the dental occlusion through loss of teeth, dental restorations, orthodontically induced tooth movement, etc. (see Avivi-Arber et al. 2011). Through the direct and indirect descending projections of face-MI neurons to brainstem interneurons and to the ...

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Sensorimotor learning refers to improvement, through practice, in the performance of sensory-guided motor behavior. Here we will focus primarily on learning studies of the hand and arm in humans. Based on our own scientific leanings and limited space for this review, we chose to neglect learning with eyes and legs.

~~Human sensorimotor learning: adaptation, skill, and beyond ...~~

Integration of sensory and motor information is one-step, among others, that underlies the successful production of goal-directed hand movements necessary for interacting with our environment. Disruption of sensorimotor integration is prevalent in many neurologic disorders, including stroke. In most ...

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Sensory systems with similar coding principles may share similar mechanisms when it comes to learning and multimodal sensory integration. The MB is a center for integration of multimodal sensory information. Thus, our model can be extended to incorporate input from different sensory modalities.

~~A spiking neural program for sensorimotor control during ...~~

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Theories of sensorimotor learning emphasize two kinds of learning-related changes in sensorimotor programs: A) chunking and increasing conscious control of the learned sensorimotor response. B) transferring the neural control of the learned sensorimotor response to lower levels of the CNS and increasing conscious control of it.

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A significant amount of research and development has gone into creating sophisticated prosthetic limbs and learning how to effectively control them. ... in prosthesis control and sensorimotor ...

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Frédéric Crevecoeur uses experimental and theoretical approaches to study how the nervous system processes sensory information and controls movements, which provides an open window into ...

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A comprehensive introduction for undergraduate students. Principles of Sensorimotor Control and Learning presents an integrated picture of sensorimotor behaviour. It provides integrated coverage of: brain and behaviour, perception and action, theory and experiment, performance (kinematics and kinetics of behaviour) and outcomes.

Despite the intensive experimental and theoretical studies for over a century, the general processes involved in neural control of posture and movement, in learning of motor behaviour in healthy subjects and in adaptation in pathology were and remain a challenging problems for the scientists in the field of sensorimotor control. The book is the outcome of the Advanced Research Workshop Sensorimotor Control, where the focus was on the state and the perspectives of the study in the field.

Sensorimotor Control and Learning is a groundbreaking text that provides a uniquely integrated treatment of sensory and motor processes, reflecting the latest research trends in both neuromotor control and the perceptual sciences. Richly illustrated and written in a clear and concise manner, the book emphasizes the intimate links between sensory and motor processes, providing an integrated view of perception and action. Features of the book: Emphasis on the multidisciplinary nature of the subject, which makes the text useful for a wide variety of readers A rigorous and thorough account of how motor behaviors are controlled, coordinated, and changed Numerous real-world examples relating to everyday experience The latest research in the field, including a unique introductory treatment of control theory Boxes highlighting and explaining more than 100 key terms, definitions and concepts throughout the text Essential background material on neuroscience, biomechanics and engineering, making it a self-contained book for students Over 600 high-quality illustrations by the author Sensorimotor Control and Learning is an indispensable resource for students of kinesiology and psychology, as well as students of other disciplines such as human factors, biomedical engineering, physiotherapy, and the neurosciences."

This book is the first to view the effects of development, aging, and practice on the control of human voluntary movement from a contemporary context. Emphasis is on the links between progress in basic motor control research and applied areas such as motor disorders and motor rehabilitation. Relevant to both professionals in the areas of motor control, movement disorders, and motor rehabilitation, and to students starting their careers in one of these actively developed areas.

This volume evolved from a workshop which addressed the general area of motor control, and the broader problems of serial organisation and sensory-motor integration of human skills. A number of specific issues are highlighted, including the neural mechanisms and disabilities of sensory-motor integration, planning and programming of action, the dynamics of interlimb coordination, amendment and updating mechanisms, and in particular, perception-action coupling and the representation of action. Underlying much of the volume are the major theoretical issues which include the debate between computational and prescriptive approaches versus the emergent properties and system dynamics approaches. The book represents a diverse approach from such disciplines as psychology,

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Electrical and mechanical engineering, human movement studies, physiotherapy, neurology, and kinesiology.

"In the present work, we seek to build on previous studies of speech motor control and learning responses to perturbed auditory feedback by demonstrating associations between sensorimotor speech processes and patterns of brain activity. In particular, we wish to draw attention to speech motor learning in comparison to speech motor control. Contemporary models of speech motor control have been constructed on the basis of feedback perturbation studies, but generally do not include mechanisms for motor learning or the associated neural substrates. In a series of three studies, we investigated the modulation of cortical beta oscillations during unperturbed speech planning and production; in response to perturbed auditory feedback; and as a measure to compare resting brain connectivity before and after a speech motor learning and speech motor control task. The first study revealed a broad role for beta desynchronization during speech planning, beginning in different regions of the left and right hemisphere and then spreading across much of the left hemisphere and a more restricted area of the right. During overt speech production, beta desynchronization was focused around pericentral regions, with additional modulations in auditory and inferior frontal regions at certain points during the utterance, corresponding in time to sensorimotor feedback processing. The patterns of beta oscillations throughout both phases partly corresponded with pathways proposed by a "dual-stream" model of auditory processing. The second study found significant associations between cortical beta power and behavioural compensation to perturbed auditory feedback. The particular regions depended on the learning phase (early/late) and also the utterance phase (planning/production). A number of brain regions outside of those proposed in speech motor control models showed this relationship with behavioural compensation, particularly in prefrontal and inferior parietal regions, including bilateral supramarginal gyrus, a region proposed to play a variety of different sensorimotor functions during speech. The final study found a broad network of brain regions with significant increases in beta band connectivity after a speech motor learning task, particularly including anterior prefrontal and right temporal regions. In comparison, a speech motor control task evoked only two significant increases in connectivity. Connectivity changes across the two tasks showed some potential functional overlap, but also point to a network for feedback processing outside of core speech motor control regions. This network would include a module for phonological working memory, as well as a link between speech motor learning and lexical-semantic processes. Our results suggest the need for expanded models of speech production. These expanded models could then serve as a basis for examining the interactions between lower-level sensorimotor control and learning processes and behavioural processes such as second-language learning and recovery of speech capacities after injury." --

A synthesis of biomechanics and neural control that draws on recent advances in robotics to address control problems solved by the human sensorimotor system. This book proposes a transdisciplinary approach to investigating human motor control that synthesizes musculoskeletal biomechanics and neural control. The authors argue that this integrated approach—which uses the framework of robotics to understand sensorimotor control problems—offers a more complete and accurate description than either a purely neural computational approach or a purely biomechanical one. The authors offer an account of motor control in which explanatory models are based on experimental evidence using mathematical approaches reminiscent of physics. These computational models yield algorithms for motor control that may be used as tools to investigate or treat diseases of the sensorimotor system and to guide the development of algorithms and hardware that can be

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incorporated into products designed to assist with the tasks of daily living. The authors focus on the insights their approach offers in understanding how movement of the arm is controlled and how the control adapts to changing environments. The book begins with muscle mechanics and control, progresses in a logical manner to planning and behavior, and describes applications in neurorehabilitation and robotics. The material is self-contained, and accessible to researchers and professionals in a range of fields, including psychology, kinesiology, neurology, computer science, and robotics.

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