Sensorimotor control of grasping: physiology and pathophysiology edited by D A Nowak, J Hermsdörfer; Cambridge University Press, Cambridge 2009, 524 pages, £75.00 (US $120.00) ISBN 978 0 52188157 9

Every day humans successfully perform the apparently simple task of reaching out and grasping an object hundreds of times without even thinking about it. This simple movement, however, has kept researchers in various fields, such as medicine, psychology, and engineering, busy trying to understand the sensorimotor control of the hand, since the beginning of its systematic investigation (Jeannerod 1981; Johansson and Westling 1984).

In thirty-four chapters, the editors combined the interdisciplinary work of ‘first-hour and last-generation neuroscientists and clinical researchers’ (page xiv), whose work significantly broadened our knowledge about what we know today about the physiology and pathophysiology of human hand movements. The book consists of four main sections: methodology, the physiology of grasping, the pathophysiology of grasping, and the therapy of impaired sensorimotor control of the hand.

The methodology section provides coherent and comprehensive information on state-of-the-art approaches to the investigation of grasping movements (including analysis of grip forces, kinematic assessment, EMG, TMS, fMRI, neuroimaging, and single- and multiple-electrode recordings in monkeys). In addition to short descriptions of the method in question (often accompanied by a critical discussion of the advantages and disadvantages), each chapter briefly summarises the main findings obtained by the application of the technique. This format provides a helpful overview of the current research in the field. The methodology section is completed by a chapter reviewing several computational models developed to describe reaching and grasping movements. In my opinion, it would have been a nice addition to include the posture-based model of the Rosenbaum group, which also provides an influential computational approach on the generation of reaching and grasping movements (eg Rosenbaum et al 2001). Furthermore, this chapter would have benefited from a section explaining some of the basic concepts, such as optimisation principles, in grasp modeling (such as minimum jerk and minimum variance).

The second part focuses on the physiology of grasping in healthy human adults, but also includes a chapter of grasp development in children and another chapter on the effects of aging on grasping in elderly people. In this section, the editors brought together authors who conducted some of the most seminal work in the field of grasping (eg M Jeannerod, J R Flanagan, R S Johansson, A M Wing, S J Lederman). In concise and well-written chapters, the authors summarise their research and relate it to the findings of other groups, therefore providing an overview of the progress in their field of expertise from the early studies up to the present. The main focus of this section is on the complex interactions between different sensory processes (predominately vision and haptics) and their influence on the planning, execution, and control of grasping movements. The idea of internal models is outlined, evidence for their existence is presented, and their role in object manipulation tasks discussed. The main emphasis is placed on the presentation of experiments dealing with the investigation of grip force control. The selection of the topics reflects the research focus of both editors. In contrast, other topics, such as task effects, the effects of object properties, or vision on movement planning, execution, and control, are only briefly addressed. Thus, readers more interested in these questions will not find detailed information. In summary, the second section of the book restates some of the central topics in the investigation of reaching and grasping movements, (see also Bennett and Castiello 1994; MacKenzie and Iberall 1994; Wing et al 1996) and brings them up to date.

The third and the fourth section of the book deal with the pathophysiology of grasping and the therapy of impaired grasping movements, respectively. To my knowledge this is the first book presenting such an exhaustive and systematic overview of neurological diseases and their specific effects on the execution and control of reach-to-grasp movements. Until now, the presentation of neurological disorders in grasping was mainly limited and focused on the rare, but illustrative, cases of optic ataxia and visual form agnosia on grasping (eg Milner and Goodale 1995).
This volume, however, dedicates ten chapters to a variety of relatively general and frequently occurring disorders such as stroke, carpal tunnel syndrome, tremor, Parkinson disease, and traumatic brain injury to name only a few, including their disturbances on the manipulative hand functions. In addition to the presentation of the effects of a specific disorder on grasp execution, each chapter provides a short description of the disorder in the introduction section, and ends with a discussion about what these impairments imply about the underlying neuronal mechanisms involved in the movement execution and control. Therefore, these chapters are of interest not only to readers working with patients, but to everyone with a general interest in neurosciences and motor control. Finally, the last section demonstrates current possibilities for treating impaired grasping movements. Novel concepts for sensorimotor rehabilitation, as well as pharmacological interventions are presented, and the effectiveness of the treatment is substantiated by presenting the results of patient studies. Furthermore, the general effects of different medical and behavioural treatments on the neuronal system are discussed.

One thing that the potential reader should know about this book: Every chapter addresses a specific topic and provides a relatively independent up-to-date synopsis of the subject dealt with. Therefore, each chapter has its own introduction and (in most cases) conclusion section. This format has the advantage that each chapter can be read on its own, and the readers can target the chapters in which they are especially interested. The book, however, does not provide a text-style summary of the current knowledge about the physiology and pathophysiology of grasping but rather contains a collection of texts, each one dealing with a specific issue of grasping research. Consequently, readers of the entire book might find repeated information causing redundancy especially in the introductory parts. In other parts of the book, redundant information is effectively reduced by providing helpful cross-references between chapters. This also contributes to making the book more coherent. An extensive index helps to quickly locate the paragraphs related to the subject of interest.

In summary, all topics covered in the volume are of high quality and authored by acknowledged experts. Each chapter is brief (less than twenty pages), clearly structured, up-to-date and concisely written. Personally, I found the first part of the book to be a useful refresher on the key topics of grasping research. The second part, which discusses the characteristics of impaired grasping by presenting a huge variety of neurological disorders, provided me with some new knowledge and was well-readable also for non-clinicians. Besides, this part nicely illustrates the applicability of the findings obtained in fundamental research. Moreover, the book provides an excellent collection of the methodological approaches currently available for investigation of the sensorimotor control of the human hand. The book will certainly be useful to both clinical and non-clinical researchers working in the field of motor control, especially those investigating reaching and grasping movements, or hand movements in general.

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Computation, cognition, and Pylyshyn edited by D Dedrick, L Trick; MIT Press, Cambridge, MA, 2009, 344 pages, $36.00 paper (£23.95) ISBN 978 0 262 51242 8

Pylyshyn’s paradigms for cognitive science
The popularity of computational models in cognitive science in general, and visual attention and perception in particular, owes much to the penetrating vision and ingenious experiments by Pylyshyn. This book is a testimony to his lasting influence. Meant to honour Pylyshyn's work, nevertheless, the book is as much a critical analysis of his work as it is a consummate advocate of his viewpoint.

The introduction by Fodor sets the stage for the rest of the book by echoing the death-knell of associationism and behaviourism that was postulated more than two decades ago (Fodor and Pylyshyn 1988). It makes the reader aware of the shortcomings of current cognitive science, and ends with the assertion that, as we go round and round in circles, Pylyshyn might just end up being the north-star that will show the right direction.

It is left to Pylyshyn himself, and rightly so, to summarise some of his life's work in the lead chapter in terms of fingers of instantiation (FINST) that are the pre-conceptual basis of all mental representations. Pylyshyn develops the idea that FINST necessarily refer to objects, which therefore exist prior to their conceptualisation, and are thus the basic units of all mental life. He specifically asserts that objects may exist prior to their placement in particular locations. Multiple object tracking (MOT) is the defining experimental paradigm which shows how the history of the object is important in its identification. Interestingly, despite this ‘strong object’ position, Pylyshyn acknowledges that these objects are not “full-blooded individual objects” and that FINST indices might be the basis of actual individuation of real objects.

Others address the important areas of vision research that owe so much to the paradigms developed by Pylyshyn, in the first part of the book devoted to vision. Scholl interprets MOT in terms of attention, insisting that MOT is just split focus attentional tracking of multiple objects. This implies that attention is of many types, and may be attached to objects, and not just to their locations or other features. Trick, Hollinsworth, and Brodeur then suggest that successful MOT performance is not only based on FINST but also on factors such as visual sensitivity, target selection, and inhibition of distractors, and that variations in these factors influence the relationship between age and MOT performance.

Goodale and Wolf discuss evidence to show how visual processing in the ventral stream (vision for perception) and the dorsal stream (vision for action) are both cognitively impenetrable in the early stages, with the latter remaining so for a relatively longer period of time. Knowing the differences and interactions between the two is essential for a complete understanding of visually guided behaviour. Somewhat in contrast, Wright and Jeffries assert that inhibition of return (IOR), despite being linked to the location cueing paradigm and ideas regarding a location map, is cognitively penetrable. Logically, return to previously detected objects can only follow the detection of those objects, and their being marked as distinct from new objects. They also review evidence of learning and motivation affecting IOR, thus showing that IOR is a higher-level phenomenon.

Essentially, however, all of these authors accept the veracity of Pylyshyn’s ideas as they modify and/or enhance them. The philosopher Bickle, however, juxtaposes a view contradictory to Pylyshyn. He takes issue with Pylyshyn's tri-level hypothesis that cognitive behaviour may be explained at three levels and theorists at each level need not concern themselves with other levels. Illustrating his argument with studies of visual attention, Bickle asserts that ignoring molecular- and cellular-level explanations is just not possible for modern cognitive science.

The second section of the book is explicitly concerned with the foundations of cognitive science proposed by Pylyshyn and provides examples of myriad interpretations and extensions of his work. Dawson expounds on the utility of connectionism using case studies of networks for classifying musical chords and mushrooms; and maintains that, despite Pylyshyn's abhorrence of connectionism, the view is not really contradictory to classical cognitive science espoused by Pylyshyn, and, indeed, may be placed in the context of the tri-level hypothesis. Reiss uses work in phonology to illustrate how assumptions regarding grand philosophical questions are essential for adequate understanding of this area. Uller tells the story of the development of the cognition of numbers in various species, thus using an evolutionary perspective delineating how we, “informavores” (Pylyshyn 1984), came into being. In a critical vein, Harnad questions
whether computation can be the only cognitive mechanism, and proposes that dynamic structures and processes are additional and perhaps alternative mechanisms underlying cognition. Brook, the philosopher, analyses Pylyshyn's criteria for items of cognitive architecture in his review of whether and what kind of representations are the building blocks of cognition. Clark uses an interesting analogy from economics to explore whether the building blocks in the area of imagery are locations or objects, concluding that both may be good candidates as building blocks of the cognitive architecture. Keane takes Clark’s work as the starting point, and presents his unequivocal thesis that visual objects are the basic referents of early vision, thus reiterating Pylyshyn’s view that objects are the primary building blocks.

What is missing in the book is an introductory or concluding commentary by the editors which could have tied together the diversity of the chapters and the two sections of the book. This would have also helped young scholars, who are just beginning to grapple with the questions facing cognitive science. Even so, the absence of such an analysis allows the reader to enjoy each chapter without preconceptions, and an accompanying sense of discovery, which can only be good! It is rare to experience the joy of discovery and the desire for more such intellectual enjoyment for a mere £24 in today’s world, which otherwise only bombards you with a plethora of repetitive information.

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