



SKILL ACQUISITION IN SPORT

RESEARCH, THEORY AND PRACTICE



2
SECOND
EDITION

EDITED BY NICOLA J. HODGES
AND A. MARK WILLIAMS

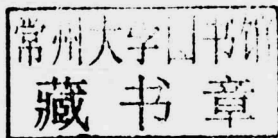


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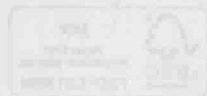
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Skill Acquisition in Sport

Research, theory and practice

Second edition

Success in sport depends upon the athlete's ability to develop and perfect a specific set of perceptual, cognitive and motor skills. Now in a fully revised and updated new edition, *Skill Acquisition in Sport* examines how we learn such skills and, in particular, considers the crucial role of practice and instruction in the skill acquisition process.

Containing 13 completely new chapters, and engaging with the significant advances in neurophysiological techniques that have profoundly shaped our understanding of motor control and development, the book provides a comprehensive review of current research and theory on skill acquisition. Leading international experts explore key topics such as:

- attentional focus;
- augmented feedback;
- observational practice and learning;
- implicit motor learning;
- mental imagery training;
- physical guidance;
- motivation and motor learning;
- neurophysiology;
- development of skill;
- joint action.

Throughout, the book addresses the implications of current research for instruction and practice in sport, making explicit connections between core science and sporting performance. No other book covers this fundamental topic in such breadth or depth, making this book important reading for any student, scholar or practitioner working in sport science, cognitive science, kinesiology, clinical and rehabilitation sciences, neurophysiology, psychology, ergonomics or robotics.

Nicola J. Hodges is Associate Professor in the School of Kinesiology, at the University of British Columbia, Canada, where she studies motor skill learning and correlates of expert performance. She has contributed to the understanding of processes involved in learning from observation and instruction and practice behaviours for elite performance.

A. Mark Williams is Professor of Motor Behaviour in the Research Institute for Sport and Exercise Sciences at Liverpool John Moores University, UK. He has published widely in areas related to expertise, skill acquisition and motor control and learning.

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Preface

N. J. Hodges and A. M. Williams

The field of skill acquisition is in an exciting period owing to the broad interest in learning processes and their applications across a variety of disciplines and professions (e.g. rehabilitation/medicine, computer science, psychology, engineering and sport). Moreover, there have been significant technical developments in the field that have facilitated understanding of the mechanisms underpinning learning (e.g. brain imaging and stimulation devices, physiological measurement tools and robotic interfaces). These advances in technology have enabled scientists to ask more refined questions influencing theory, research and applied practice in equal measure. We are therefore very pleased and excited to showcase the second edition of this book, which attempts to highlight the dynamic and vibrant nature of the field and the novelty of approaches and ideas that have evolved since the previous edition.

The new edition of the book is revamped with 21 new chapters focusing on traditional topics (e.g. feedback, practice scheduling and perceptual-cognitive skill) as well as new ones that have gained prominence over recent years (e.g. joint action and coordination, imagery and observation, and developmental readiness for motor learning). We have a list of contributors from all around the globe including Australia, Canada, France, Hong Kong, Ireland, Macedonia, the Netherlands, New Zealand, Northern Ireland, Portugal, Singapore, the UK and the USA. A novel section includes two chapters that focus on applied issues in order to illustrate the increasing translational impact of this field of study, particularly with high-level athletes. In these last chapters, insights from the Asia-Pacific and from the UK illustrate the challenges and opportunities presented when attempting to translate research into practice and how work undertaken in the field can inform research and theoretical development.

The book is broadly divided into five parts, namely 'Presenting information', 'Optimizing practice conditions', 'Issues in motor learning', 'Skilled performance' and 'Research, theory and practice: challenges and solutions'. In the opening section on 'Presenting information', there are four chapters that address issues related to the effective presentation of instructions, feedback and demonstrations. *Magill and Anderson* provide a review of the role of augmented feedback in motor learning. The chapter contains a number of practical illustrations of how technical advances in sport have allowed feedback to be used in relatively novel and innovative ways. In

the second chapter, *Ong and Hodges* show how mixed schedules of demonstrations and physical practice can potentially aid skill learning by promoting the acquisition of different types of knowledge. They suggest ways in which the usefulness of demonstrations can be optimized, particularly in regard to when and how frequently they should be presented. In the third chapter, *Lohse, Wulf and Lewthwaite* illustrate the pervasive effects of attentional focus on motor skill learning, with particular reference to the measurement of efficiency. An externally directed focus of attention affects learning outcomes as well as how these are achieved. In the final chapter in this section, *Masters and Poolton* revisit the topic of implicit motor learning and show how this field of research has progressed over the last decade. They show how methods of presenting information (e.g. through analogies or at a subliminal level of awareness) can impact long-term retention, particularly under conditions that simulate competitive situations and pressures. They offer some interesting speculations about the evolutionary mechanisms underpinning the effectiveness of more implicit learning techniques.

In the second part, we present five chapters that have implications for how practice should be structured and organized to bring about effective motor skill learning. In the first chapter, *Lee* reminds us how important it is to structure practice appropriately to enhance learning, rather than to gain fast yet temporary performance benefits. He provides a concise review of the contextual interference literature, with a focus on contemporary research. In the second chapter, *Moran, Campbell, Holmes and MacIntyre* review the potential of covert methods of practice, including imagery and action observation, to enhance learning. They discuss how these practice methods (both cognitive and neurophysiological) can help refine and enhance motor skill learning. An ecological, constraints-based view of learning is considered in the third chapter by *Dauids, Araújo, Hristovski, Passos and Chow*. These authors offer thought-provoking ideas concerning instruction pedagogy that places emphasis on the individuality of the learner and the practice environment. We return to more traditional, information processing-based methods of studying and inferring learning in the fourth chapter, by *Shea and Wright*. These authors provide an overview of contemporary research and theory relating to sequence learning and what this means for how movements are remembered and may be generalized to new contexts. In the final chapter of this part, *Hodges and Campagnaro* evaluate the benefits and costs associated with providing physical guidance during motor skill learning. They consider how advances in rehabilitation and robotics have implications for effective physical guidance techniques in sport.

A total of five chapters are presented in the third section. These chapters relate to broader issues in motor skill learning, including the role of motivation, sleep and rest, and the underlying neurophysiology of motor learning. *Lewthwaite and Wulf* remind us of the often-neglected role of affect and emotion in teaching, and highlight the effectiveness of various practice methods, including feedback and instruction, providing interesting examples of how practice can be enhanced by subtle manipulations to the beliefs and motivations of the learner. In the next chapter, *Trempe and Proteau* review a burgeoning area of interest pertaining to the learning that takes place between practice sessions. They provide a stimulating evaluation of

current evidence relating to the value of rest (and sleep) for motor learning. This chapter is followed by an equally fascinating discussion on developmental markers of readiness for motor skill acquisition by *Anderson, Magill and Thowarecq*. Although primarily giving a historical review of critical and sensitive periods of development, these authors make a compelling case for the need for researchers and practitioners to consider when sport-related practice should start to be of most benefit to the learner. Next, *Eskenazi, van der Wel and Sebanz* present an informative discussion of research relating to shared or joint actions, which has implications for coordinative behaviours required in opponent or team sports and games. They focus on the types of processes engaged when individuals share in tasks or goals and what this means for performance and learning. In the final chapter in this part, *Wadden, Borich and Boyd* review the neurophysiology of motor learning. These authors provide a comprehensive and current review of research in this area and attempt to illustrate how understanding of the neurophysiology of learning and skilled performance can help us develop better environments to promote performance enhancement.

The acquisition of expertise is the primary focus in the fourth section of the book. We present five chapters related to skill learning in elite, high-performance athletes. *Côté, Murphy-Mills and Abernethy* present the developmental model of sport participation, which details two potential pathways to success in sport. They review support for their model and then go beyond this to present seven clear and testable postulates about the relative benefits of early versus late specialization in sport. In the next chapter, *Abernethy, Farrow, Gorman and Mann* consider how skilled athletes can be differentiated from their less-skilled counterparts in terms of perceptual-cognitive skills related to attention and anticipation. In the following chapter, *Causser, Janelle, Vickers and Williams* evaluate how effectively this knowledge has filtered down to aid training of athletes. They focus on methods employed to train 'quiet eye' as well as 'game intelligence' skills such as anticipation and decision-making. The final two chapters in this part provide a somewhat different focus from the first three in that skilled performers are studied to help understand how actions and sensory-motor experiences influence perception and cognitions and the memory and transfer of skills across contexts. *Kontra, Albert and Beilock* show us how movement experiences and skilled performance in sports such as ice hockey can impact on the way we look at the world and make sense of situations. They argue that movement in general can impact on classroom learning. *Breslin, Schmidt and Lee* then provide examples of what they term 'especial skills'. These skills seem to be caused by high amounts of practice under specific conditions and are evidenced by significantly superior performance in one context (such as the free-throw line in basketball), in comparison with other distances and what would be predicted based on generalization theories of learning.

We conclude our book with two chapters that engage discussion about the difficulties and successes in moving from and between research, theory and practice. *Williams, Ford, Causser, Logan and Murray* continue this discussion by drawing upon their recent experiences working with elite athletes in the English Institute of Sport. *Button and Farrow* provide a Southern Hemisphere perspective, based on their roles as academic researchers and applied sport scientists in New Zealand and Australia

respectively. In both chapters, attempts are made to engage the reader in understanding how the various topics addressed in this book have led to interventions with elite athletes, and hence these last two chapters serve an additional summative role for the book as a whole.

Our broad aims in compiling these chapters and bringing together world leaders in this field are to (a) continue to stimulate research interest; (b) provide a one-stop source for students of motor learning in undergraduate and graduate classes; and (c) provide a resource for practitioners looking to employ an evidence-based framework to guide their coaching practice. We acknowledge that the book will probably be more accessible to academics and students of movement science disciplines (e.g. Sport and Exercise Science, Kinesiology, Human Kinetics, Physical Therapy) than people without this background, but our hope is that the material presented will motivate these individuals to disseminate the knowledge presented across a range of different learning and performance environments.

Nicola Hodges

Mark Williams

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Nicola Hodges

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Mark Williams

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