TWELFTH EDITION

MOTOR LEARNING AND CONTROL

Concepts and Applications

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MOTOR LEARNING AND CONTROL: CONCEPTS AND APPLICATIONS, TWELFTH EDITION

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Detailed Contents

Preface

This twelfth edition primarily updates the previous edition by adding more recent research and interpretations of the concepts and theoretical views associated with those concepts that were in the eleventh edition. Similar to the previous editions this new edition continues its two most distinctive features as an introductory motor learning and control textbook: its overall approach to the study of motor learning and control and the organization of the implementation of that approach. In every edition of this book, the overall approach has been the presentation of motor learning and control "concepts" to identify the common theme of each chapter. The concepts should be viewed as generalized statements and conclusions synthesized from collections of research findings. Following the concept statement is a description of a real-world application of the concept, which is then followed by discussions of specific topics and issues associated with the concept. An important part of these discussions are summaries of research evidence, on which we base our present knowledge of each topic and issue, as well as the implications of this knowledge for practitioners. The benefit of this organizational scheme is the presentation of motor learning and control as a set of principles and guidelines for practitioners, which are based on research evidence rather than on tradition or "how things have always been done."

Our goal for this edition continues to be to provide an introductory study of motor learning and control for students who aspire to become practitioners in various professions. As in previous editions, the achievement of this goal involves the inclusion of research examples that demonstrate the evidence-based foundation for the motor learning and control concepts. It is important to note that the research examples are just that—examples; the intent of the discussion of research about a specific topic, therefore, is not to present an extensive review of the research literature or to investigate the various controversial views that may exist on a topic.

NEW TO THIS EDITION

New Research

Because an important goal of this book is to provide research evidence to support the various concepts and applications, it is essential to regularly update the research to maintain the book's relevance. As in previous editions, each chapter of the twelfth edition includes updated research in the text, the *A Closer Look* boxes, and in the *Related Readings* sections. Research related to motor learning and control continues to increase, as evidenced by the ever-expanding amount of research articles and chapters published each year. Because of the availability of this new information, it is essential that an introductory textbook provide the most up-to-date evidence available to support the numerous concepts and applications that can be derived from this research. But, the caveat here is to not overwhelm the reader with a litany of research studies.

It is with this point in mind that we have as a primary intent to present examples of research studies that provide empirical support for the concepts discussed rather than to provide exhaustive reviews of the available research.

NEW OR EXPANDED TOPICS IN SPECIFIC CHAPTERS

Chapter 1: The Classification of Motor Skills

- Updated and added new research relevant to the concept discussed in this chapter

Chapter 2: The Measurement of Motor Performance

- Clarified situations in which discrimination reaction time is important
- Clarified the distinction between consistency and bias in error measures
- Described additional tools for recording movement kinematics
- Added a new figure showing the four types of EEG waves
- Expanded the description of transcranial magnetic stimulation (TMS)
- Updated and added new research relevant to the concept discussed in the chapter

Chapter 3: Motor Abilities

- Updated and added new research relevant to the concept discussed in the chapter
- Expanded discussion of research evidence related to the relative independence of static and dynamic balance

Chapter 4: Neuromotor Basis for Motor Control

- Updated several figures within the chapter
- Updated and added new research relevant to the concept discussed in the chapter

Chapter 5: Motor Control Theories

- Added section describing and discussing the OPTIMAL theory of motor learning and control
- Included discussion of OPTIMAL theory in section on "The Present State of the Control Theories Issue"
- Updated and added new research relevant to the concept discussed in the chapter

Chapter 6: Sensory Components of Motor Control

- Updated several figures within the chapter and added a figure on the knee jerk reflex
- Updated the definition of proprioception
- Provided additional information on how muscle spindles encode joint angle
- Added new research about how sensory neuropathy patients control movement
- Added new research showing tendon vibration can improve and impair motor performance
- Described technological innovations related to the temporal occlusion procedure
- Updated and added new research relevant to the concept discussed in the chapter

Chapter 7: Performance and Motor Control Characteristics of Functional Skills

- Added new information to section on the role of visual information in the speed-accuracy trade-off
- Added text about the role of vision in prehension
- Added section to "A Closer Look" (on the Constraint-Induced movement therapy intervention strategy) describing and discussing the HABIT (Hand-Arm Bimanual Intensive Therapy) strategy to include therapeutic strategies for improving bimanual coordination skills for people with cerebral palsy (CP)
- Added to section on handwriting information about the role of sensory feedback
- Expanded discussion of "Why do spontaneous gait transitions occur?" to update prevalent hypotheses
- Expanded discussion in "A Closer Look" (Visual Cues Can Aid Walking with Parkinson's Disease") to update research evidence supporting the visual cueing benefit
- Updated and added new research relevant to the concept discussed in the chapter

Chapter 8: Action Preparation

- Added a new example in the "A Closer Look" section on applying Hick's Law to a sport performance situation
- Added new information about reaction time in the sprint start
- Related the "A Closer Look" section on the performance expectancy phenomenon to the OPTIMAL theory of motor learning
- Clarified how research on piano playing provides evidence for the preparation of movement sequences
- Updated and added new research relevant to the concept discussed in the chapter

Chapter 9: Attention as a Limited Capacity Resource

- Updated the Closer Look box on how cell phone use influences driving
- Updated and expanded discussion of neural characteristics associated with automaticity of motor skill performance
- Expanded discussion of research evidence related to attention allocation and vision while driving a car
- Updated and added new research relevant to the concept discussed in the chapter

Chapter 10: Memory Components, Forgetting, and Strategies

- Added information about a proposed fourth subsystem in working memory
- Updated and added new research relevant to the concept discussed in the chapter

Chapter 11: Defining and Assessing Learning

- Updated and added new research relevant to the concept discussed in the chapter

Chapter 12: The Stages of Learning

- Added a new section on brain changes in elite athletes
- Updated and added new research relevant to the concept discussed in the chapter

Chapter 13: Transfer of Learning

- Added "dance" to list of activities in Introduction to which the transfer of learning concept applies
- Revised section "Using Gentile's Taxonomy to Develop Skills" by deleting section heading and connecting discussion to previous section "Sequencing Skills to be Learned"
- Added discussion to "A Closer Look" on "Bilateral Transfer Training for Using an Upper-Extremity Prosthesis" to update research evidence supporting the experiment described
- Updated and added new research relevant to the concept discussed in the chapter

Chapter 14: Demonstration and Verbal Instructions

- Updated "A Closer Look" section on clinical implications of a mirror neuron system with an example of feedforward video self-modeling in stroke rehabilitation
- Added information on the brain areas that are active during action observation
- Added information about self-observation in the section on novices observing novices
- Updated information on the frequency of observing demonstrations
- Updated information on auditory modeling
- Provided an additional example of the potential downsides of viewing a demonstration
- Added information about how visual cueing can enhance the effectiveness of demonstrations
- Updated and added new research relevant to the concept discussed in the chapter

Chapter 15: Augmented Feedback

- Updated and expanded discussion in "A Closer Look" on augmented feedback as motivation
- Added surgical skills learning example to discussion of "Augmented Feedback May Not Be Needed for Skill Acquisition"
- Expanded discussion of why beginners ask for KR after good trials during practice

- Added sub-section "Manual Guidance as Augmented Feedback" to section "Types of Knowledge of Performance"
- Updated and added new research relevant to the concept discussed in the chapter

Chapter 16: Practice Variability and Specificity

- Updated information on how performance errors benefit learning
- Added information about using the contextual interference effect to enhance learning of perceptual-cognitive skills
- Added information about how the contextual interference effect might encourage refinement of error detection and correction processes
- Provided an additional example of research on the especial skills effect
- Updated and added new research relevant to the concept discussed in the chapter

Chapter 17: The Amount and Distribution of Practice

- Clarified use of term "procedural skills"
- Related research on treadmill training and falls risk to discussion of "The Overlearning Strategy Can Lead to Poor Test Performance"
- Updated and added new research relevant to the concept discussed in the chapter

Chapter 18: Whole and Part Practice

- Updated and added new research relevant to the concept discussed in the chapter

Chapter 19: Mental Practice

- Revised discussion in section "Mental Practice as Part of a General Preparation Strategy that Aids Learning" by including more recent research involving learning to shoot free throws in basketball; deleted Figure 19.2 and related discussion
- Added specific reference in discussion of "Brain Activity Hypothesis" for reading a review of research on neural plasticity related to imagery
- Updated and added new research relevant to the concept discussed in the chapter

SUCCESSFUL FEATURES

Motor Learning and Control: Concepts and Applications continues to offer the following features from the previous editions that have helped enhance student learning.

Concepts
Each chapter begins with a concept statement to present a principle or conclusion that describes the focus of the chapter. The goal of these statements is to provide students a guide for understanding the chapter content, which provides the discussion of issues and research that led to the concept statement.

Application
Following the concept statement, the application section describes in practical terms the relevance of the chapter concept and content to everyday experiences and professional practice.

Application Problem to Solve
This feature, which follows the application section at the beginning of each chapter, presents a specific application problem for students to work on as they engage in reading the discussion section of the chapter.

Discussion
This section presents the specific information from which the concept statement was derived. It includes the key topics and issues relevant to the chapter concept along with summaries and examples of research that provide evidence to support the various points presented in the chapter.

A Closer Look Boxes
Each chapter contains several boxes. The title for each box indicates its content. These boxes typically serve one of several purposes: to provide more detail about a research study than is provided in the

text; to describe a situation that applies a point in the discussion to a professional practice situation; or to describe a relevant issue that allows the student to explore a topic beyond the limits of the text.

Summary
Each chapter concludes with a summary that presents the main ideas addressed in the discussion section. Using this tool, the student can return easily to a topic in the chapter for clarification or study.

Points for the Practitioner
This feature describes how the chapter topic relates to the practice or performance setting. It encourages students to think about how they will use this information in practical ways.

Related Readings
For students who want to know more about a particular topic, this list at the end of each chapter offers carefully selected research journal articles, books, and book chapters for further exploration.

Study Questions
A set of questions appears at the end of each chapter to encourage students to review and analyze the chapter content.

Specific Application Problem as a Study Question
The final study question presents an application problem to solve as a culminating experience for the student to use the information presented in the chapter. This problem differs from the one located at the beginning of the chapter by describing a situation students might experience in their future professional experience.

Definition Boxes
Key terms, which are highlighted in the text in boldface type, are defined in corresponding boxes for easy reference. Other important terms in the text appear in italics for emphasis.

Lab Links
The previous four editions included, as part of McGraw-Hill's Online Learning Center for this book, a laboratory manual of laboratory experiences for most chapters. These experiences are available for this edition as well. In the twelfth edition, these laboratory experiences are identified by "Lab Links" boxes in the margins.

Glossary
At the end of the book, all the key terms defined in the definition boxes are included in a comprehensive glossary. This glossary is useful as a quick reference and a helpful review to prepare for examinations.

Name Index
In addition to the regular subject index, this book features a name index, which identifies and locates all the names referred to in the book. Included in this list are the names of important people who have been or are leaders in the field of motor learning and control.

DIGITAL RESOURCES

The twelfth edition of *Motor Learning and Control* is now available online with Connect, McGraw-Hill Education's integrated assignment and assessment platform. Connect also offers SmartBook for the new edition, which is the first adaptive reading experience proven to improve grades and help students study more effectively. All of the title's website content is also available on Connect, including access to the full course Instructor's Manual, Test Bank, and PowerPoint slides, and Student Lab Manual.

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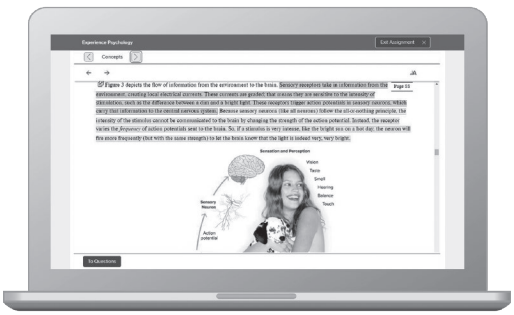

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Eastern Washington University

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Richard wants to acknowledge students and colleagues throughout the world who have told or sent him their ideas and suggestions concerning ways to make the book work better for them in the classes they teach. He greatly appreciates their interest in assisting his efforts to develop this new edition. On a more personal level, he again acknowledges and thanks his wife, Susan Koff, for her support, encouragement, suggestions, and patience. He is dedicating this edition to her for her constancy in "being there."

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New York City, New York

David I. Anderson
San Francisco, California

From Richard:

To my wife

Susan R. Koff

From David:

To my wife

Suzanne D. Anderson