

# FUNDAMENTALS OF MOTOR BEHAVIOR

**Jeffrey T. Fairbrother**

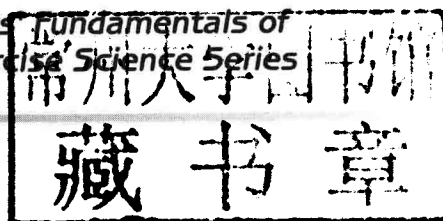


*Human Kinetics' Fundamentals of  
Sport and Exercise Science Series*

# FUNDAMENTALS OF MOTOR BEHAVIOR



Human Kinetics Fundamentals of  
Sport and Exercise Science Series



***Jeffrey T. Fairbrother, PhD***

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HUMAN KINETICS

## Library of Congress Cataloging-In-Publication Data

Fairbrother, Jeffrey T., 1964-

Fundamentals of motor behavior / Jeffrey T. Fairbrother.

p. cm. -- (Human Kinetics' fundamentals of sport and exercise science series)

Includes bibliographical references and index.

ISBN-13: 978-0-7360-7714-9 (soft cover)

ISBN-10: 0-7360-7714-6 (soft cover)

I. Motor learning--Textbooks. I. Title.

BF295.F35 2010

612.7'6--dc22

2009039395

ISBN-10: 0-7360-7714-6 (print)

ISBN-13: 978-0-7360-7714-9 (print)

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The Web addresses cited in this text were current as of September 2009, unless otherwise noted.

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Printed in the United States of America      10 9 8 7 6 5 4 3 2 1

The paper in this book is certified under a sustainable forestry program.

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# **FUNDAMENTALS**

## **OF**

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# **MOTOR**

# **BEHAVIOR**

*To Jenna, for the wonder and joy  
you have brought to my life*

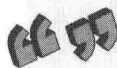
# *Series Preface*

The sport sciences have matured impressively over the past 40 years. Subdisciplines in kinesiology have established their own rigorous paths of research, and physical education in its many forms is now an accepted discipline in higher education. Our need now is not only for comprehensive resources that contain all the knowledge that the field has acquired, but also for resources that summarize the foundations of each of the sport sciences for the variety of people who make use of that information today. Understanding the basic topics, goals, and applications of the subdisciplines in kinesiology is critical for students and professionals in many walks of life. Human Kinetics has developed the Fundamentals of Sport and Exercise Science series with these needs in mind.

This and the other books in the series will not provide you with all the in-depth knowledge required for earning an advanced degree or for opening a practice in this subject area. This book will not make you an expert on the subject. What this book will do is give you an excellent grounding in the key themes, terms, history, and status of the subject in both the academic and professional worlds. You can use this grounding as a jumping-off point for studying more in-depth resources and for generating questions for more experienced people in the field. We've even included an annotated list of additional resources for you to consult as you continue your journey.

You might be using this book to help you improve your professional skills or to assess the potential job market. You might want to learn about a new subject, supplement a textbook, or introduce a colleague or client to this exciting subject area. In any of these cases, this book will be your guide to the basics of this subject. It is succinct,

## ***Key to Icons***



Look for the giant quotation marks, which set off noteworthy quotes from researchers and professionals in the field.



Skill Insights include quirky or surprising "Did you know?" types of information.



Technology Highlights show how researchers and professionals are using technology to analyze movement and advance the field.



Success Stories highlight influential individuals in the field. Through these sidebars, you will learn how researchers and professionals apply their knowledge of the subject to their work, and you'll be able to explore possible career paths in the field.

informative, and entertaining. You will begin the book with many questions, and you will surely finish it with many more questions. But they will be more thoughtful, complex, substantive questions. We hope that you will use this book to help the sport sciences, and this subject in particular, continue to prosper for another generation.

# *Preface*

There are few observable human behaviors that do not involve some sort of movement. Accordingly, the study of human movement is an important part of our efforts to understand human behavior in general. In addition, movement is a fundamental part of our lives. We use movement to negotiate our way through each day, completing various activities of daily living such as brushing our teeth, opening a can of food, or bathing ourselves. We also use movement to help us perform at work. Even the most sedentary jobs require a vast number of motor skills such as typing, writing, or dialing a telephone. Some jobs, such as those held by professional athletes, are almost entirely based on movement skills.

We also use movement to enhance our health and the quality and enjoyment of our lives. The benefits of regular exercise are well established, but we also use movement when we participate in a wide range of recreational activities such as art (e.g., painting, drawing, or pottery), music, recreational sport, or hobbies (e.g., model building or woodworking). In fact, movement is so central to our lives that most of us enjoy watching others engage in various forms of movement or appreciate the outcome of those movements (e.g., dance, music, art, or sport).

The purpose of this book is to provide an overview of the field of motor behavior. Although it includes many of the same topics you will find in more traditional textbooks, it differs from them in a couple of important ways. First, this book is written so that you do not need specialized knowledge to understand the concepts presented, and the material frequently focuses on why the information is relevant in the real world. Second, the book is organized in a way that first introduces the field and then provides some ideas about what you might be able to do with the knowledge you will gain by entering the field. The “what you can do” part is addressed in chapter 2 as I look at potential career options such as coach, physical educator, or university professor, and throughout the book as I present information about the types of activities you will be able to engage in such as performance analysis and instructional design.

This book is divided into two major sections, the first of which welcomes you to the field of motor behavior. In chapter 1, you will learn what the field of motor behavior is, how it emerged, what questions interest people in the field, and how they go about trying to answer these questions. In chapter 2, you will learn about some of the career paths that relate to motor behavior, and you will be shown some practical examples of how knowledge from the field can be applied in a variety of performance settings.

The second section of the book will introduce you to some of the topics that are actually studied in the field of motor behavior. The goal in this section is to introduce you to topics of interest, show you how they are examined, and demonstrate

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how the knowledge resulting from these examinations can be applied to improve performance in a variety of settings. In chapter 3, you will learn about some of the techniques that practitioners use to observe behavior, as well as the systems for classifying motor behavior in order to identify performance demands. In chapter 4, you will learn about how people control movements. Some movements are slow enough to allow the performer to make adjustments during the action while others are so rapid that they must be entirely planned in advance. Of course, many actions have aspects of both types of movements. Starting a car's ignition provides a good example of such a combined action. The initial movement to turn the key is rapid and probably planned in advance, but the portion during which you hold the key in the "on" position is performed more slowly as you wait for the sound of the ignition.

In chapter 5, you will read about how people learn motor skills. Topics include learning without actual awareness of the learning (i.e., implicit learning), mental practice, learning through observation of others, and the ways in which the type and amount of feedback influence learning. In chapter 6, you will learn about the capabilities and limitations that humans possess with respect to meeting certain task demands. In many situations, the amount of time needed to react to an event is much greater than the length of the event itself. For example, a jab in boxing probably takes about 50 milliseconds to execute, but it takes over 100 milliseconds to process the information that tells you the jab is taking place. The seeming limitation is countered by the ability to anticipate upcoming events. Without the capability to anticipate, a boxing match would not be possible.

In chapter 7, you will learn about some of the considerations involved in establishing procedures for scheduling the practice of multiple tasks to most benefit learning. In chapter 8, you will learn about the motor skill learning cycle, which guides practitioners through the general steps of developing (and revising when needed) a sound instructional approach. Key aspects of the cycle include the development of goals, instructions, target behaviors, and the corresponding measures and feedback.

In an effort to maintain a conversational tone throughout this book, I wrote it as if I were simply sharing with you my understanding of motor behavior. Although this approach was effective, it also presented a challenge when it came to giving credit to the works on which my understanding is based. I have made every effort to indicate the sources for my ideas with reference citations throughout the text. In some cases, the ideas came directly from the cited work. In other cases, the references were included because they had clearly influenced my thinking on a certain topic or served as good examples from the research literature.

My understanding of motor behavior has obviously been influenced by the books and articles that I have read. The two books that have most influenced my thinking have been Schmidt and Wrisberg's *Motor Performance and Learning* and Schmidt and Lee's *Motor Control and Learning*. At the end of the book I have also included a bibliography of readings that have contributed to my own education in the field of motor behavior.

The book closes, in the epilogue, with a discussion about the future of the field of motor behavior. You will learn about some of the unresolved questions relating to how people control their movements and learn motor skills, as well as about how

the results of research can best be applied to practical settings. Finally, you will be asked to consider the ways in which your interests in motor behavior might lead you to contribute to the evolution of the field. Motor behavior is a fascinating field because it focuses on something so central to all of our lives—movement. I hope this book helps you understand the principles of motor behavior and how they apply to a variety of professions (and our everyday lives). I wish you the best as you continue your study of this exciting aspect of human behavior.

# *Acknowledgments*

I want to thank several people for their contributions as I wrote this book. Craig A. Wrisberg first recommended me to the publisher as a potential author. His advice, ideas, and feedback influenced much of the material in this book. Craig has been a generous colleague, mentor, and friend. Acquisitions editor Judy Wright and developmental editor Chris Drews did an outstanding job of patiently guiding me through the unfamiliar territory of book publishing. Other people who helped me better understand the performance demands of certain sports and movement activities included Joao Barros (swimming), Greg Young (soccer), and Duncan Simpson (tennis).

Finally, I offer my deep gratitude to my wife, Julie Fairbrother, for her unwavering support and encouragement, and for keeping me focused as I neared the finish line.

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# I

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## PART

# *Welcome to Motor Behavior*

In the first part of this book, two preliminary questions about the field of motor behavior are asked and answered. Chapter 1 answers the question “What is motor behavior?” by briefly describing some of the issues and problems that interest people in the field. In addition, a short history of motor behavior is presented to illustrate the origin of the field and the way in which it relates to other disciplines interested in human performance and learning. The first chapter closes with a description of some of the fields that are closely related to motor behavior, such as sport psychology, physical education, occupational therapy, and human factors.

Chapter 2 answers the question “What can I do with motor behavior?” in two distinct ways. First, the chapter relates some examples of how the concepts and principles of motor behavior can be used to address performance and learning issues in the real world. Second, you will learn about the various career paths that involve an understanding of motor behavior, including the academic path, several professional paths, and some other creative career paths that are probably not as easy to recognize.

Chapters 1 and 2 include the first of the technology highlights that are a recurring feature throughout the book. The technology highlights describe how professionals in fields relying on motor behavior use technology to better understand and, when possible, facilitate motor performance and learning. Technology highlights include topics like video analysis, simulator training, computerized testing software, eye tracking, and various other training and measurement devices.



# What Is Motor Behavior?



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***In this chapter you will learn the following:***

- ✓ What the three subdisciplines within the field of motor behavior are
- ✓ How the field of motor behavior developed historically
- ✓ About several professional fields that use the principles of motor behavior

Champions  
keep playing until  
they get it right.

Billie Jean King

Imagine that you are asked to determine which individuals out of an extremely large group are most likely to succeed at a given task. Imagine also that the success of your selection process has great importance not only to you and the people you are evaluating, but also to the entire population of the country in which you live. How would you go about making your decisions? This is the scenario that military officials in the United States faced in selecting and training pilots during World War II. During the first two years of involvement, approximately 400,000 men applied to become pilots through the Aviation Cadet Program. To test such large numbers, selection procedures needed to be readily available and relatively inexpensive. The success of the selection process depended upon identifying who was likely to succeed and who was likely to fail during training. Being too strict during selection would not produce enough pilots to meet the growing demand caused by the war. On the other hand, a less stringent selection process would waste limited resources and risk lives. What types of tests would you use to predict whether someone would be a good pilot? Ultimately, the military used a battery of intelligence, personality, and perceptual-motor skills tests. Of the candidates selected, about 75 percent made it through the first stage of training,



Office of Air Force History, Maxwell Air Force Base.

**Principles of motor performance were used to select pilots during World War II.**