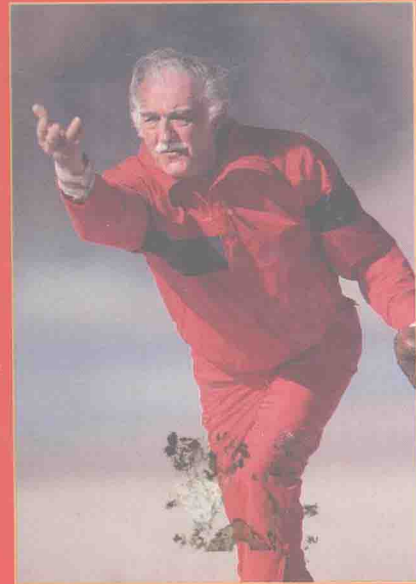
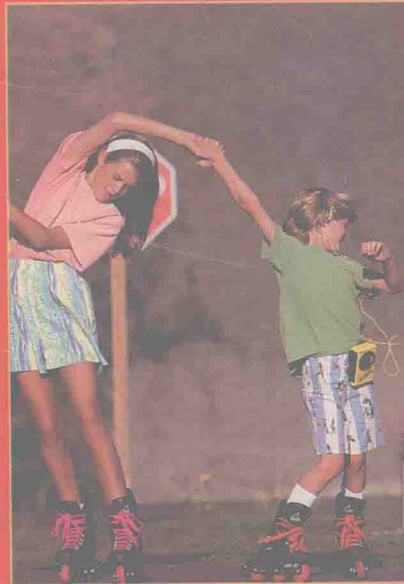
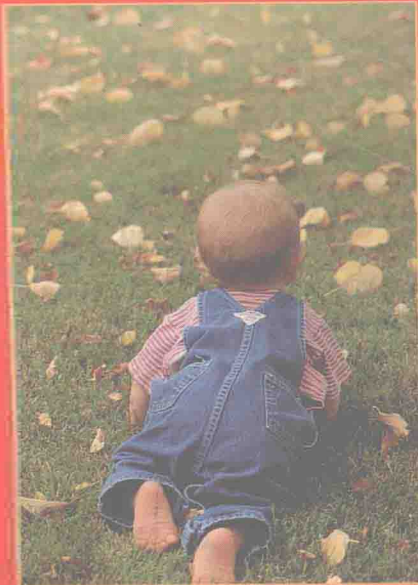


SECOND EDITION

# LIFE SPAN MOTOR DEVELOPMENT



Kathleen M. Hayw

SECOND EDITION

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# LIFE SPAN MOTOR DEVELOPMENT



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Kathleen M. Haywood, PhD  
University of Missouri–St. Louis



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### **Human Kinetics**

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*United States:* Human Kinetics, P.O. Box 5076, Champaign, IL 61825-5076

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(088) 277 1555

e-mail: [humank@hkaustralia.com](mailto:humank@hkaustralia.com)

*New Zealand:* Human Kinetics, P.O. Box 105-231, Auckland 1

(09) 523 3462

e-mail: [humank@hknewz.com](mailto:humank@hknewz.com)

To my family in return for their unwavering support

# Preface

True to its name, the area of study termed *motor development* continues to develop! Just as with living organisms, the changes are exciting; they open up a new world of possibilities for researchers, instructors, and students alike. Because the process of change is ongoing, one could argue that any motor development text needs to be revised as soon as it is in print. But it does take a few years before the changes can be placed into perspective such that newcomers to motor development will benefit. The time has arrived when students can gain richer insights into motor development from new material and perspectives, and this second edition of *Life Span Motor Development* is the result.

Change in motor development has taken many forms. Foremost is the emergence of a new perspective—the dynamic systems, or ecological, perspective. This new theoretical approach, introduced in chapter 1, stimulates new questions about the developmental process, reveals limitations of other perspectives, and raises questions about assumptions with which we have become comfortable. I have taken the dynamic systems perspective in many places throughout this second edition, sometimes contrasting it with more traditional viewpoints.

New research instrumentation and statistical techniques have allowed data on motor development to be gathered and analyzed more quickly and accurately than ever before. Integrated video-computer systems now allow movement analysis at a speed and sophistication not previously possible. Though you will not be burdened with the details of this research, you will benefit in chapters 3 and 4 from the information obtained. A relatively new statistical technique, meta-analysis, has been used to examine gender differences in motor development, a topic discussed in chapter 5.

Continued research also changes our thinking about various aspects of development. For example, progressive resistance training has often been considered of little value to prepubescent children. However, you are likely to reach a different conclusion after reading chapter 7.

Research has been conducted on new topics in motor development and in correlated areas of study. For example, researchers have recently examined how children structure their knowledge about skills and sports. This material has been incorporated into chapter 8. And there is now sufficient material on the development of self-esteem for skill performance that an entirely new concept has been added to chapter 9.

Though revised, *Life Span Motor Development* is still intended for the newcomer to motor development. My goal has been to improve upon the first edition, providing a strong foundation in the basics along with the most current information. Several sections have been expanded, and the book's format redesigned into three parts. Part I consists of chapters 1 and 2, providing an overview of the study of motor development followed by a discussion of physical growth processes occurring in various body systems. Part II, comprised of chapters 3, 4, and 5, follows motor development from infancy through older adulthood. Part III, the final four chapters of the book, discusses how motor development is affected by perceptual and cognitive development, physiological responses to training, and psychosocial factors.

This second edition includes twice as many photos and more drawings, tables, and graphs. More learning tools have been incorporated. You will find key terms highlighted in the text and listed at the end of each chapter; these

terms are defined, along with others, in the new glossary at the end of the book. Each chapter closes with a chapter summary, a list of key terms, discussion questions, and suggested readings. These elements will enhance your learning as you begin your exploration of the field of motor development.

The most enjoyable aspect of writing this book has been meeting and speaking with instructors and students who used the first edi-

tion. Associating actual names and faces with readers has been a tremendous help to me through the long revision process. I tend now to see *Life Span Motor Development* not merely as a text but, like motor development itself, as an ongoing process. I look forward to incorporating the research some of you will do and the suggestions many of you will make in the future.

# Preface to the First Edition

Change in motor behavior from infancy to older adulthood is a fascinating process to study. Just a few years ago, study in motor development was limited to children and adolescents. Today, however, motor development is an expanding area of study. Increasingly, motor development is recognized as a continuous developmental process that must include the study of motor behaviors over the entire life span. Certainly age-related changes in motor behavior and skill performance are not limited to persons under 20 years of age. It is important, then, that changes in motor development that occur throughout adulthood and older adulthood also are studied in a systematic way. *Life Span Motor Development* is intended to fill the need for a comprehensive motor development text that takes a life span view.

In 1982, several members of the Motor Development Academy of the American Alliance for Health, Physical Education, Recreation and Dance developed a list of minimum exit competencies appropriate for student coursework in motor development. These competencies include (a) the ability to formulate a developmental perspective, especially from a life span viewpoint; (b) knowledge of changing motor behavior across the life span; (c) knowledge of the factors affecting motor development, including physical growth and physiological change, perceptual change, cognitive change, sociocultural practices, and interventions; and (d) the ability to apply motor development knowledge. This text covers the suggested areas of knowledge; course instructors may wish to further enhance the application of motor development knowledge with supplemental activities in laboratory and clinical settings.

The text is written as an undergraduate introductory text, so little background knowledge in the movement sciences is required. Persons who are interested in motor behavior as it relates to physical education, developmental psychology, elementary education, early childhood education, special education, and gerontology should find this book instructive as well. It is assumed that most readers anticipate working with children, adolescents, and perhaps young adults. With the increasing proportion of adults in the population who are concerned with developing and maintaining an active lifestyle, the demand for individuals with knowledge of life span motor development will afford increased employment opportunities.

The breadth of information pertaining to motor development throughout the life span often seems overwhelming to beginning students. One way to handle the large volume of detailed information is to conceptualize how this information supports broader generalizations about motor development. A conceptual understanding of motor development is particularly useful for students whose application of this knowledge may occur in a wide array of professional settings. For this reason, *Life Span Motor Development* focuses on concepts in motor development throughout.

The book consists of nine chapters divided into two parts. Part I (chapters 1 to 5) concerns the developmental perspective on human behavior and includes changes in physical growth and aging and changes in motor performance. Part II (chapters 6 to 9) includes a consideration of the correlates of motor behaviors—that is, the factors that influence individual performance levels such as physiological, perceptual, and cognitive changes—and sociocultural influences. Featured within each chapter are several

motor development concepts. After the concept is introduced and discussed, a brief summary is provided before moving on to the next concept.

The book's chapters and concepts are organized to provide a logical sequence of study beginning with parameters of physical growth and development, continuing with motor skill acquisition, and progressing to correlates of motor development. Other than in chapters 3, 4, and 5, which concern specific developmental periods, the discussion covers the entire life span. Concepts within the chapters are supported by discussions of relevant research and study and by specific examples of their application in natural settings. Instructors may wish to

introduce additional materials for various chapters and concepts as appropriate; because each chapter is a complete unit, the chapters may be read in a different order than presented to meet the needs of individual instructors or students without jeopardizing the integrity of the book.

The concepts emphasized in *Life Span Motor Development* should help you make knowledgeable decisions concerning motor development. I hope that as you gain an understanding and appreciation of the process of developmental change in motor behavior, you will continue to seek new information in the study of motor development.



# Acknowledgments

As with any work this size, many people provided valuable assistance. Several professionals read first edition chapters for accuracy: John Strupel, MD and Elizabeth Sweeney, BSN read chapter 2; Bruce Clark, PhD read chapter 7; and Susan Greendorfer, PhD offered valuable suggestions on chapter 9. Mary Ann Robertson, PhD furnished materials from which many of the chapter 4 illustrations were drawn.

The photographs in chapter 2 were taken by Brian Speicher. Michael, Douglas, and Jennifer Imergoot; and Matthew and Christina Haywood posed for the pictures. Laura Haywood posed for the pictures in chapter 3. Ann Wagner typed many of the manuscript tables and figure captions for the first edition. Cynthia Haywood assisted in checking the reference list. The support of Elizabeth Sweeney, Lynn Imergoot, Stephanie Ross, Cathy Lewis, and members of the Motor Development Research Consortium with the first edition is gratefully acknowledged.

Many colleagues made contributions to the second edition. Special thanks to Jane Clark for help with incorporating the dynamic systems perspective. Maureen Weiss was kind enough to provide much of the material for the new concept in chapter 9. Thanks, too, to Kathleen Williams and Ann VanSant for collaborating on some of the new research added to chapter 5. Continued thanks to Mary Ann Robertson for her helpful suggestions.

William Long, OD, PhD provided a new photograph for the second edition of chapter 9 and did much of the photo development work on the new photographs. Anna Tramelli posed for the new photos in chapter 3 and Cathy Lewis for all the “grasp and grip” photos. John Haubenstricker, Ann VanSant, and Jill Whitall provided film tracings for new figures in chapter 4. Thanks once again to all my motor development colleagues whose many helpful comments along the way have made this a better text.

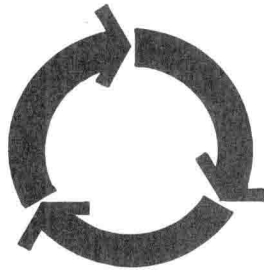
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# Part I

## Foundations of Motor Development



Part I sets the stage for our discussion of motor development. We begin, in chapter 1, with a definition of motor development and why it applies beyond childhood to the entire life span. We also review some of the field's basic terms. With the history of motor development as a guide, you'll learn that as knowledge about motor development has changed over time, so too have people's perspectives and that interpretations of motor behavior over the years have often been colored by the prevailing viewpoint. We end this chapter by reviewing several critical issues debated throughout the history of motor development.

In chapter 2 we explore physical growth and aging. Growth and age-related changes in skill performance are so entwined that it makes little sense to study motor development without a thorough knowledge of growth and the aging process. You will learn about overall body growth as well as growth and aging in each of the relevant body systems so that we can link the advancement in the various systems with the appearance of new motor skills. We also examine factors that specifically affect physical growth and aging.



# Chapter 1

## The Developmental Perspective



### CHAPTER CONCEPTS

#### 1.1

Motor performance undergoes many age-related changes during an individual's life span.

#### 1.2

To understand motor development, you must understand the terminology used in the field.

#### 1.3

We can view motor development from many different theoretical perspectives.

#### 1.4

Some aspects of development are topics of discussion and debate.

Learning and performing motor skills is a lifelong challenge. The process begins early in life with the attainment of postural control and grasping skills. It continues with the acquisition of locomotor skills and manipulative skills, such as throwing. During childhood, basic skills are refined and combined into movement sequences to produce complex skills. Adolescents continue to acquire movement sequences and improve their abilities to match motor skills to the goal of a task and the environment in which it is performed. Throughout infancy, childhood, and adolescence, the physical body is growing and maturing. Perception of the surrounding world becomes keener, and mental capacity increases as mental skills improve. Social skills, too, are acquired as new relationships are formed. With all these changes, the performance of motor skills must be accommodated and modified.

Motor skills are usually perfected during late adolescence and young adulthood. Elite athletes exemplify the ultimate in motor skill development. Such skilled performers have maximized their motor performance based on their physical size and condition and their cognitive and social experiences. Developmental changes are most dramatic early in life, but they do not cease with adulthood—physiological changes continue to occur, and environmental experiences refine individuals' perceptions, mental skills, and social relationships. Perhaps adults attempt to perform skills in new ways, but both new and well-learned skills must continue to accommodate these ongoing, though subtle, changes. This is particularly true as individuals age beyond young adulthood, and the pace of physical, mental, and social changes increases.



## THE LIFE SPAN PERSPECTIVE

Movement patterns change continually over the life span. This ongoing change poses important questions for educators. For example, what influences the potential for skilled performance? Is it determined by genetics, or can parents and educators provide experiences to promote skill development? Does skilled performance necessarily decline after young adulthood? By studying the developmental process with its many facets and intricacies, we can begin to unravel the answers to questions such as these.

### CONCEPT 1.1

Motor performance undergoes many age-related changes during an individual's life span.

## Traditional Focus on Children

It is traditional to think of *motor development* solely as the process of skill acquisition in children—that is, the progression from unskilled performance in very young children to intermediate skill mastery during childhood, to rela-

tively skilled performance during late adolescence. Working from this perspective, a motor developmentalist studies motor behavior by testing children of different ages and monitoring the course of their skill acquisition. The presumption that motor development concerns only children and adolescents has developed because the majority of study in motor development has concentrated on the early years of the life span. But researchers now recognize that the study of development in general and motor development in particular should encompass the entire life span. By studying the processes underlying behavioral change throughout the life span, motor developmentalists seek not only to describe such changes but also to explain them.

---

In this text, the field of motor development concerns the study of processes underlying behavioral change throughout the life span.

---

## Increasing Interest in Older Adults

A growing segment of the human population consists of older adults. Increasingly, older adults seek to improve the quality of their lives through healthful and enjoyable physical activities, so we can no longer view older adulthood as a period of sedentary living and illness. We recognize that development does not stop at puberty with the cessation of physical growth, or at age 21, or at any other landmark of young adulthood. Changes in motor behavior, both substantive and qualitative, occur during older adulthood, too. Motor patterns vary with age from birth to death (VanSant, 1989). Because the earliest developmental research focused on children's motor behavior, many aspects of motor behavior in older adults are largely unexplored, and specific scientific knowledge of changes in motor skill is sparse. Gaining more complex knowledge and a better understanding

of motor behavior in older adults is an important challenge for motor developmentalists.

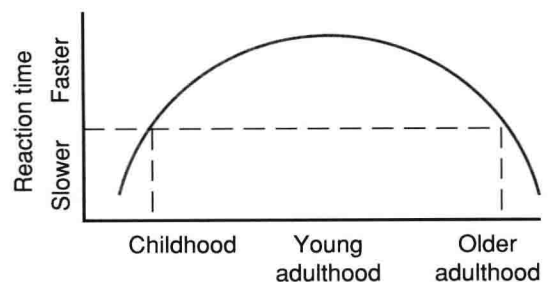
## Significance of the Life Span Perspective

Students—even those who anticipate working only with children or adolescents—can gain a fuller appreciation of motor development by viewing it from a life span perspective. Consider, for example, that children and older adults often display similar motor behavior. Both groups are relatively slower than young adults in their reaction time to a visual stimulus (see Figure 1.1). But are the causes of this difference in behavior the same for children and older adults? No. Children and older adults cognitively process information about the visual stimulus in different ways. We will discuss differential causes of behavior in more detail throughout the text.

---

Behavior is the product of many influences.

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**Figure 1.1** Behavior might be identical at two points of the life span but the underlying processes contributing to that behavior might be different. Reaction time has been observed to improve during childhood and adolescence, reach its fastest in young adulthood, and slow in older adulthood. This is represented in the theoretical model above. At two ages, the average reaction time could be the same, yet developmentalists believe different processes bring about the relatively slower reaction times in childhood and older adulthood.



Our understanding of behavior is based on the integration of many influences—psychological, sociological, biological, physiological, cognitive, mechanical, and so on. Similarly, our greatest understanding of motor development is based on the integration of many behavior changes within a phase of development. We cannot possibly study all behavioral influences at once. Even though the discussions in this text may focus for a time on a particular aspect of behavioral change, the goal of developmentalists is to explain behavioral change throughout life from a global viewpoint. We encounter a broader range of causes and effects from this viewpoint, which in turn provides the basis for a more complete understanding of the factors involved in behavioral changes. More importantly, perhaps, a life span perspective enables students of motor development to better understand motor behavior and to consider how educators and health professionals might be able to influence individuals' optimal motor development throughout life.

### REVIEW 1.1

In discussing motor development in this text, we emphasize a life span perspective that relates to the processes underlying changes in motor behavior throughout life. The study of motor development involves both the description and the explanation of changes in motor behavior. Ultimately, motor developmentalists integrate knowledge of various biological, psychological, sociological, cognitive, and mechanical factors that influence behavior at particular levels of development. This method is quite different from studying changes as a function of time, such as when we study a particular motor behavior in several age groups to identify the differences among those groups or to establish norms or averages for particular ages. Developmentalists go beyond this descriptive level to study the processes underlying change that account for age-group differences.

Because changes in motor behavior occur from infancy through older adulthood, we must consider a broad range of influences on behavioral change. Consequently, we view motor skill development with a knowledge of preceding processes as well as potential effects.



## TERMINOLOGY IN MOTOR DEVELOPMENT

Understanding the terms used in the study of the developmental process will facilitate your learning. Every field of study develops its own terminology. Sometimes these terms hinder students' ability to read and comprehend pertinent literature, especially students new to the field. It can be frustrating to discover that a word you use in everyday conversation has a specific, different meaning when used in a scientific context. Yet precise communication among those interested in the topic often requires these specific meanings. Let's examine some common motor development terms.

### CONCEPT 1.2

To understand motor development, you must understand the terminology used in the field.

## Growth and Development

Two basic concepts discussed in this text focus on the terms *growth* and *development*.

### Growth

Although *growth* and *development* are sometimes used interchangeably, *growth* means a