

Kathleen Haywood and Nancy Getchell

Life span motor development

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Atgoffir staff a myfyrwyr bod hawlfraint ar y darn hwn ac ar y gwaith y cafodd ei gymryd ohono. Gwnaed y Copi Digidol hwn o dan delerau trwydded CLA sy'n caniatáu i chi:

- fynd at gopi a'i lwytho i lawr;
- argraffu copi;

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Ac eithrio'r hyn a ganiateir gan gyfraith hawlfraint, ni chaniateir copïo, cadw neu ddosbarthu pellach (yn cynnwys drwy e-bost) heb ganiatâd deiliad yr hawlfraint.

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Mae hon yn fersiwn ddigidol o ddeunydd hawlfraint a wnaed dan drwydded gan ddeiliad yr hawl, ac ni ellir sicrhau ei chywirdeb. Cyfeiriwch at yr argraffiad cyhoeddedig gwreiddiol os gwelwch yn dda.

Trwyddedwyd i'w ddefnyddio ar gyfer y cwrs BMSA4003 - Developing and Supporting Physical Development in Early Childhood

Teitl: Life span motor development

Enw'r Awdur: Kathleen Haywood and Nancy Getchell

Enw'r Cyhoeddwr: Human Kinetics

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Fundamental Concepts



CHAPTER OBJECTIVES

This chapter

- defines motor development,
- distinguishes developmental issues from other concerns,
- describes some of the basic tools used by researchers in motor development,
- explains why development occurs over a life span, and
- introduces a model that guides our discussion of motor development.



Motor Development in the Real World

The *Up* Series

In 1964, director Paul Almond filmed a group of 14 British children, all 7 years old, from diverse socioeconomic backgrounds and created a documentary about their lives titled *7 Up!* In 1971, Michael Apted followed up with *7 Plus Seven*, and he has brought out a new installment of the series every 7 years since, following these same individuals through childhood and adolescence, into adulthood, and now into middle age. Apted hoped to explore the influence of the British class system over time and see if the Jesuit motto “Give me a child until he is seven and I will give you the man” held true. The latest installment, *56 Up*, premiered on British television on May 14, 2012, and was released in the United States in January 2013. In total, the *Up* series will show the lives of the participants over the course of 49 years, from childhood into middle adulthood, thus providing a window into the group and individual development.

If we developed a series of documentaries addressing motor development, who might watch? Many professionals might be interested. Educators, especially physical and early childhood educators, might be interested in which practices work best and whether they are developmentally appropriate. Therapists would want to know the factors that affect movement abilities. Engineers and designers might be interested in changes throughout adulthood in order to make appropriately sized and arranged living spaces, control panels, work equipment, sport gear, and vehicles. Health care providers might want to determine how movement and exercise early in life affect health status later on. Clearly, then, motor development interests many people for many reasons. Indeed, we can learn a great deal by examining change in movement patterns—and why it occurs—from birth until old age. Movement is an integral part of our lives, and its change is inevitable.

Defining Motor Development

Our imaginary documentary series might give you a rough idea of what motor development is. Let’s now be more exact and give the field some boundaries, much as a producer would do in order to decide which segments are appropriate for the motor development film and which are not.

Development is defined by several characteristics. First, it is a continuous process of change in functional capacity. Think of functional capacity as the capability to exist—to live, move, and work—in the real world. This is a cumulative process. Living organisms are always developing, but the amount of change may be more noticeable, or less noticeable, at various points in the life span.

Second, development is related to (but not dependent on) age. As age advances, development proceeds. However, development can be faster or slower at different times, and rates of development can differ among individuals of the same age. Individuals do not necessarily advance in age and advance in development at the

same rate. Further, development does not *stop* at a particular age but rather continues throughout life.

Third, development involves sequential change. One step leads to the next step in an orderly and irreversible fashion. This change results from interactions both within the individual and between the individual and the environment. All individuals of a species undergo predictable patterns of development, but the result of development is always a group of unique individuals.

Individuals function in a variety of arenas, including the physical, social, cognitive, and psychological. Hence, we use terms such as **cognitive development** or **social development** to address the process of change in particular arenas. Social scientists often specialize in the study of one aspect of development.

We use the term **motor development** to refer to the development of movement abilities. Those who study motor development explore developmental changes in movements as well as the factors underlying those changes. Such study addresses both the process of change and the resultant movement outcome. Not all change in movement constitutes development. For example, if a tennis teacher elicits a change in a student's forehand stroke by changing the student's grip on the racket, we do not view the change as motor development. Rather, we use the term **motor learning**, which refers to movement changes that are relatively permanent but related to *experience* or practice rather than age. We use the term **motor behavior** when we prefer not to distinguish between motor learning and motor development or when we want to include both.

Motor control refers to the nervous system's control of the muscles that permits skilled and coordinated movements. In recent years, researchers in motor development and in motor control have found much in common. Understanding how the nervous system and movement abilities change with age expands our knowledge of motor control, and we now see much overlap in motor development and control research.



Scan news websites such as MSNBC.com or CNN.com for stories related to motor development. What key words did you select to search for stories on this topic besides *motor* and *development* in order to focus in on this topic?

Undoubtedly, you have heard the term *development* paired with the term *growth*, as in "growth and development." **Physical growth** is a quantitative increase in size or magnitude. Living organisms experience a period of growth in physical size. For humans, this growth period starts with conception and ends in late adolescence or the early 20s. Changes in the size of tissues after the physical growth period (e.g., an increase in muscle mass with resistance training) are described with other terms. Thus, the phrase *growth and development* includes change in both size and functional capacity.

The term *maturation* is also paired with the term *growth*, but it is not the same as development. **Maturation** connotes progress toward physical maturity, the state of optimal functional integration of an individual's body systems and the ability to reproduce. Development continues long after physical maturity is reached.

Physiological change does not stop at the end of the physical growth period. Rather, it can occur throughout life. Physiological change tends to be slower after the growth period but nevertheless remains prominent. The term **aging** can be used in a broad sense to refer to the process of growing older regardless of chronological age; it can also refer specifically to changes that lead to a loss of adaptability or function and eventually to death (Spirduso, Francis, & MacRae, 2005).

Motor development refers to the continuous, age-related process of change in movement as well as the interacting constraints (or factors) in the individual, environment, and task that drive these changes.

Motor learning refers to the relatively permanent gains in motor skill capability associated with practice or experience (Schmidt & Lee, 2005).

Motor control is the study of the neural, physical, and behavioral aspects of movement (Schmidt & Lee, 2005).

Physical growth is an increase in size or body mass resulting from an increase in complete, already formed body parts (Timiras, 1972).

Physiological maturation is a qualitative advance in biological makeup and may refer to cell, organ, or system advancement in biochemical composition rather than to size alone (Teeple, 1978).

Aging is the process, occurring with the passage of time, that leads to loss of adaptability or full function and eventually to death (Spirduso, Francis, & MacRae, 2005).

The physiological processes of growth and aging fall on a continuum of life span development. For many years, researchers examined motor development almost exclusively from early childhood through puberty. However, the population across the globe has aged. In many countries—including the United States, China, Russia, Australia, Canada, and the majority of the European Union's nations—by 2030 at least 13% of the population will be aged 65 years or older (Kinsella & Velkoff, 2001). This change brings more urgency to the need for better understanding of motor development in the later years. Although some motor development students might be particularly interested in one portion of the continuum, motor development as a field still concerns change in movement across the life span. Understanding what drives change in one part of the life span often helps us understand change in another part. This process of examining change is part of adopting a developmental perspective.

..... Constraints: A Model for Studying Motor Development

It is useful to have a model or plan for studying the change in movement that occurs over the life span. A model helps us include all the relevant factors in our observation of motor behavior. This is particularly true as we think about the complexity of motor skills and how our skills change over the life span. For this textbook, we adopted a model associated with a contemporary theoretical approach known as the ecological perspective (see chapter 2). We find that this model helps us make sense of developmental changes by providing a framework for observing change. We believe this model—Newell's constraints model—will help you better understand motor development across the life span.

Newell's Model

Karl Newell (1986) suggested that movements arise from the interactions of the organism, the environment in which the movement occurs, and the task to be undertaken. If any of these three factors change, the resultant movement changes. We can picture the three factors as points on a triangle with a circle of arrows representing their interaction (figure 1.1). Because we are concerned only with human movement here, we use the term *individual* instead of *organism*. In short, to understand movement, we must consider the relationships between the characteristics of the individual mover, his surroundings, and his purpose or reasons for moving. From the interaction of all these characteristics, specific movements emerge. This model reminds us that we must consider all three corners of the triangle in order to understand motor development.

Picture the different ways in which individuals can walk—for example, a toddler taking her first steps, a child walking in deep sand, an adult moving across an icy patch, or an older adult trying to catch a bus. In each example, the individual must modify his or her walking pattern in some way. These examples illustrate that changing one of the factors often results in a change in the interaction with one or both of the other factors, and a different way of walking arises from the interaction. For example, whether you are barefoot or wearing rubber-soled shoes might not make a difference when you're walking across a dry tile floor, but your walk might change notably if the floor were wet and slippery. The *interaction* of individual, task, and environment changes the movement, and, over time, patterns of interactions lead to changes in motor development.

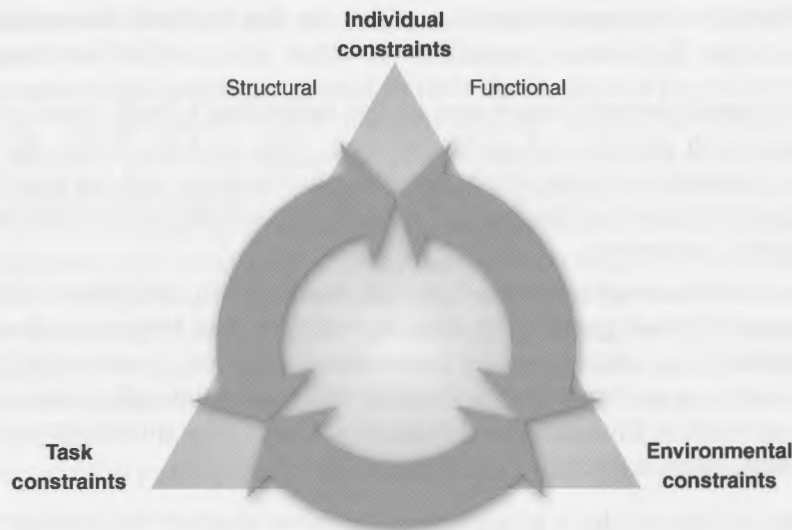


FIGURE 1.1 Newell's model of constraints.

Why is Newell's model so helpful in studying motor development? It reflects the dynamic, constantly changing interactions in motor development. It allows us to look at the individual and the many body systems that constantly undergo age-related changes. At the same time, the model emphasizes the influence of where the individual moves (environment) and what the individual does (task) on individual movements. Changes in the individual lead to changes in his or her interaction with the environment and task and subsequently change the way the individual moves. For example, a young child may enjoy tumbling on mats in his preschool. His parents may put him in a gymnastics class (change in environment); at that class, the instructors may focus on equipment rather than tumbling stunts (change in task). Over time and through his experience focusing on specific equipment in the gymnastics class, the boy may become proficient at the pommel horse. Another example is an older adult who, because of hip arthritis, chooses to walk only when absolutely necessary and stops attending her walking group. Changes in her social environment lead to disengagement in exercise, which in turn leads to loss of strength, flexibility, and mobility and, ultimately, to more hip pain. In both of these examples, the individual, environment, and task influence—and are influenced by—each other.

Newell calls the three factors we placed on the points of our triangle **constraints**. A constraint is somewhat like a restraint: It *limits* or *discourages* (in this case, movement) but at the same time it *permits* or *encourages* (in this case, other movements). It's important not to consider constraints as negative or bad. Constraints simply provide channels from which movements most easily emerge. A riverbed acts as a constraint: It restrains the river water from flowing anywhere and everywhere but it also channels the water to follow a specific path. Movement constraints are characteristics that shape movement. They restrain and channel movement to a particular time and place in space; that is, they give movement a particular form.

Individual constraints, the top point on our triangle, are a person's unique physical and mental characteristics. For example, height, limb length, strength, and motivation can all influence the way an individual moves. Consider the swimmer with a disability in figure 1.2. The disability constrains, but does not prevent, this

A **constraint** is a characteristic of the individual, environment, or task that encourages some movements while discouraging others.

Individual constraints are a person's or organism's unique physical and mental characteristics.

individual's ability to swim; it simply modifies the way in which the swimmer performs her strokes. Individual constraints are either structural or functional.

Structural constraints are individual constraints related to the body's structure.

Functional constraints are individual constraints related to behavioral function.

- **Structural constraints** relate to the individual's body structure. They change with growth and aging; however, they tend to change slowly over time. Examples include height, weight, muscle mass, and leg length. As we discuss these changes throughout the text, you will see how structural factors constrain movement.
- **Functional constraints** relate not to structure but to behavioral function. Examples include motivation, fear, experiences, and attentional focus. Such constraints can change over a much shorter period of time. For instance, you might be motivated to run several miles in cool weather but not in hot, humid weather. This functional constraint shapes your movement to running, walking, or even sitting.

For many professionals, it is important to know whether the student's or client's movement is being shaped by structural or functional constraints. Such information can help one understand how much a movement could change in a short time and whether a change in an environmental or task constraint would be in order to modify the resultant movements. For example, knowing that young volleyball players cannot block a ball at the net because they are not yet at their



FIGURE 1.2 This swimmer's truncated limb is a structural constraint that gives rise to a swimming movement that is different from that of someone without a truncated limb.

adult height would lead a youth sports organizer to change the task by using a lower net height.

Environmental constraints exist outside the body, as a property of the world around us. They are global rather than task specific and can be physical or socio-cultural. Physical environmental constraints are characteristics of the environment, such as temperature, amount of light, humidity, gravity, and the surfaces of floors and walls. The example of a runner not feeling motivated to run in humidity represents the functional constraint of motivation interacting with two environmental constraints—temperature and humidity—to constrain movement.

Environmental constraints are constraints related to the world around us.

One's sociocultural environment can also be a strong force in encouraging or discouraging behaviors, including movement behaviors. One example is how change in the sociocultural environment in Western society has changed the involvement of girls and women in sport over the past three decades. In the 1950s, society did not expect girls to participate in sport. As a result, girls were channeled away from sport.

Task constraints are also external to the body. They include the goals of a movement or activity. These constraints differ from individual motivation or goals in that they are specific to the task. For example, in basketball the goal is to get the ball in the hoop—this is true for any individual playing the game. Second, task constraints include the rules that surround a movement or activity. If we think about basketball, players could get down the court much more quickly if they could simply run with the ball rather than dribble it. However, the rules dictate that players *must* dribble while running with the ball, meaning that the resultant movement is constrained to include bouncing the ball. Finally, the equipment we use is a task constraint. For example, using a strung racket rather than a wood paddle changes the game played on an enclosed (racquetball) court. Recall also the case of the youth sports organizer, who by lowering net height used the interaction of a structural individual constraint (body height) and a task constraint to allow a certain movement (blocking) to emerge in the game played by young volleyball players. You can probably imagine many of the task constraints in the depicted situation. The basketball player must pass the ball to a teammate while protecting the ball from a defender.

Task constraints include the goals and rule structure of a particular movement or activity.

Throughout this discussion of motor development we demonstrate how changing individual, environmental, and task constraints shape the movement that arises from their interaction. Newell's model guides us in identifying the developmental factors affecting movements, helps us create developmentally appropriate tasks and environments, and helps us understand individual movers as different from group norms or averages.

Changing Views on the Role of Constraints

It is important to recognize that in the history of motor development research certain researchers and practitioners focused primarily on individual factors to the exclusion of others. For example, in the 1940s it was assumed that an individual constraint—specifically, the structural constraint of the nervous system alone—shaped movement in infants and children (see chapter 2 for a discussion of this concept). Later, in the 1960s, developmentalists commonly believed that environmental and task constraints, more than individual constraints, shaped movement. Only recently have motor developmentalists begun focusing on all three types of constraints simultaneously as well as carefully examining how constraints interact with and influence each other over time.

When one or two types of constraints are deemphasized, so is the rich effect of the three constraints interacting to shape movement. Thus, such an approach limits the resulting view of the emerging movement. In our survey of motor development we identify the effects of these various viewpoints on the importance of the three constraints. Sometimes what we know about an aspect of motor development is influenced by the perspective of the researcher who studied that behavior. It is much like seeing the color of a flower change as we try on sunglasses with lenses of different colors. We might “color” our conclusions about motor development as we emphasize one type of constraint and deemphasize other types.



Imagine you are a physical educator or a coach. Knowing how height and body size change with growth, how would you adapt the game of basketball (especially the task, through the equipment used) so that movements (shooting, dribbling, passing) remain nearly the same during the growth years?

Newell’s model is more global than most models previously used in the study of motor development. We can better account for the complexity of age-related change in movement with this model through the interactions of individual, environment, and task. Keep the model in mind throughout our survey of motor development.

Constraints and Atypical Development

To understand the basics of constraints, we explain concepts using typical motor development. That is, we use examples that describe what we might expect in people with average individual constraints (strength, height, motivation), who move in typical environments (gymnasiums, playgrounds, grocery stores), and who perform normal tasks (sport, activities of daily living). Essentially, this is motor development “on average.” People can develop in different ways and still be considered to be in an average range. However, individuals can deviate from the average developmental course in a variety of ways. In some instances, development is advanced (motor skills appear sooner than expected) or delayed (motor skills appear later than expected). In others, development is actually different (the person moves in unique ways). When we discuss constraints and atypical development, we focus on delayed and different development, particularly in individuals with disabilities. Interacting constraints lead to movement changes over individuals’ lives. Therefore, we know that differences in structural and functional individual constraints can lead to atypical developmental trajectories. For example, a child with cerebral palsy may be delayed in the acquisition of fundamental motor skills due to muscle spasticity, or an adult with multiple sclerosis will see motor proficiency diminish as a function of deteriorating myelin sheaths in the brain and spinal cord. In certain conditions, people may exhibit motor coordination delays that can be overcome with enhanced practice or experience. In the language of constraints, enhanced practice represents a change in task constraints. Movement practitioners must keep in mind how movement can change as a result of changing constraints and thereby adjust environment and task constraints to accommodate differences in individual constraints. Throughout the text we provide examples of research related to atypical development.

How Do We Know It Is Change?

.....
We’ve established that age-related change is fundamental in the study of motor development and the developmental perspective. Developmentalists are focused on

change. How do we know, though, that a change is age related and not a fluctuation of behavior (a good or bad day on the court, for example) or a product of our measuring instrument (a radar gun versus video motion analysis)? One way to discern developmental change is to carefully observe individuals' movements and then describe differences between people of different age groups or instances of observation.



WEB STUDY GUIDE Gain experience in observing movement by doing Lab Activity 1.1, Observation as a Tool of Inquiry, in the web study guide. Go to www.HumanKinetics.com/LifeSpanMotorDevelopment.

In addition, behavioral scientists use statistical techniques that can identify significant change. We sometimes discuss these techniques in the context of a research study. For now, let's focus on the straightforward technique of picturing change by graphing an aspect of development over time. We can then see whether a trend is emerging.

Picturing Change

When we picture age-related measurements by graphing, we traditionally put time or age on the horizontal axis. Time can be measured in days, weeks, months, years, or decades, depending on our frame of reference. A measurement of interest in infancy might be plotted in days or weeks, whereas a measurement of interest over the life span might be plotted in years or decades.

The measurement is plotted on the vertical axis. We usually arrange the measurements so that "more," "faster," or "more advanced" is higher on the scale. Figure 1.3 shows a typical graph of the measurement of growth in childhood. It is common to take a measurement periodically and plot its value at selected chronological ages. We assume that change has occurred consistently in the time between our measurements, so we often connect our data points to make a line. When we graph change using a developmental perspective, we should not make the assumption that more is always better.

Individuals move in a variety of ways that are qualitatively different. Some ways of moving may result in longer throws or faster runs, but that does not imply that children who do not move this way are in error or are wrong. It simply means that these children move at a different or lower developmental level.

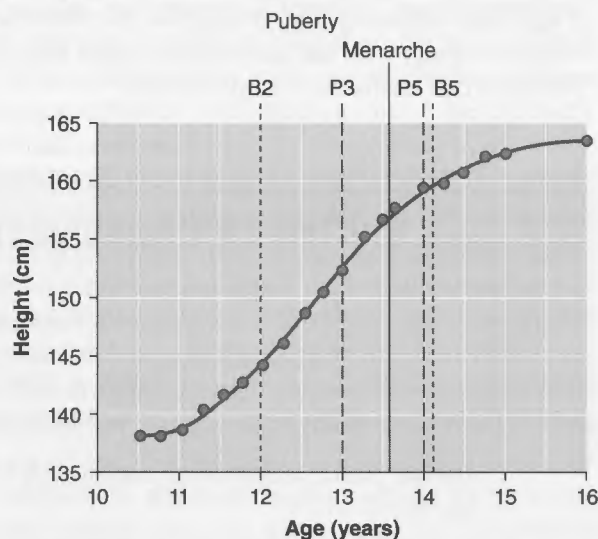


FIGURE 1.3 A typical graphical representation of growth in childhood.

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WEB STUDY GUIDE Practice graphing to help picture change in Lab Activity 1.2, Graphing Developmental Data, in the web study guide. Go to www.HumanKinetics.com/LifeSpanMotorDevelopment.

Researching Developmental Change

In the study of development, we ideally watch an individual or group change with age for the entire length of the period we are interested in. This is termed a **longitudinal research study**. The difficulty here comes when our frame of reference is years or decades. For example, a teacher may be interested in the changes in locomotor skills across childhood. We can see that an individual researcher might be able to do only a few such studies in his or her lifetime. This approach would not inform us about motor development very quickly!

Researchers have several ways of learning more in a shorter time. One of these techniques is termed a **cross-sectional research study**. In a cross-sectional study, researchers select individuals or groups at chosen points in the age span of interest. For example, researchers interested in change during adolescence might measure a group of 13-year-olds, a group of 15-year-olds, a group of 17-year-olds, and so on. When the measurements of each group are plotted, we assume that any observed change reflects the same change we would observe in a single group over the whole time period. The advantage of this method is that researchers can study development in a short time. The disadvantage is that we never really observe change; we merely infer it from age group differences. If something else were responsible for the age group differences, we could be fooled into thinking the differences were caused by developmental change.

Consider the example of tricycles. At one time, all tricycles were metal and shaped so that the seat was relatively high off the ground. Children under 3 years of age had difficulty just getting on the tricycle. Then someone invented the Big Wheel tricycle, with the large front wheel and the seat only inches off the ground. Toddlers can easily sit on this vehicle.

A **longitudinal research study** is one in which the same individual or group is observed performing the same tasks or behaviors on numerous occasions over a long time.

A **cross-sectional research study** is one in which developmental change is inferred by observing individuals or groups of varying ages at one point in time.

Can You Tell It's Developmental? A Litmus Test

Armed with definitions of motor development and motor learning, you still might find it difficult to distinguish whether a particular behavior is a matter of learning or development. Mary Ann Robertson (1988, p. 130) suggests that the answers to three questions help us distinguish developmental issues and topics.

1. Are we interested in what behavior is like now and why the behavior is the way it is?
2. Are we interested in what behavior was like before our present observation, and why?
3. Are we interested in how the present behavior is going to change in the future, and why?

Students of both motor learning and motor development answer yes to the first question, but only developmentalists answer yes to the second and third questions. Motor learning specialists are concerned with making changes that bring about a relatively permanent change in behavior within a short time. Motor developmentalists focus on a longer time during which a sequence of changes occurs. Developmentalists might introduce a change in task or environmental constraints to make either or both age appropriate while realizing that the task or environment will have to change again and again as individuals age and change.

Let's pretend that a researcher did a cross-sectional study on coordination of the cycling motion of the legs in toddlers at the ages of 1.5, 2.0, 2.5, and 3.0 years. The study was done just 1 year after the Big Wheel tricycle came on the market (note: as a piece of equipment, the Big Wheel is a task constraint). The researcher observed that toddlers 2.5 and 3.0 years of age could coordinate this movement and concluded that approximately 2.5 years was the age at which toddlers could coordinate the cycling movement of the legs. But what if the researcher had done the study a year earlier, before any of the children would have been on a Big Wheel? The researcher might have observed that *none* of the children could coordinate the cycling movement because none would have been able to ride the high-seat tricycle. The researcher would then have concluded that this coordination developed after the age of 3.0 years.

The invention of the Big Wheel gave a **cohort**, or mini-generation, of toddlers earlier practice in coordinating the cycling movement. Older cohorts could not practice the movement until they were big enough to get up on the higher tricycle. Thus, one cohort had an experience that another did not. Such a cohort difference can fool researchers in a cross-sectional study, leading them to associate performance differences between age groups with age alone and not factors such as exposure to new inventions. Researchers must be particularly aware of cohort differences when examining aging populations due to rapidly changing technologies. For example, many older adults may not own or frequently use computers. Let's say a researcher wants to examine differences in driving techniques among drivers of different age groups and uses a computer simulation in which the car is controlled by a joystick. Older adults may show differences in performance because they are unfamiliar with computer joysticks rather than because of true differences in driving technique. (In fact, children who are not yet eligible to drive may perform better because of their experiences with video games.) Researchers must take care to control for cohort differences.

Researchers have, however, devised a clever way to identify cohort influences while at the same time conducting developmental research in less time than required by a longitudinal study. They do it by combining longitudinal and cross-sectional studies. In effect, they conduct several small longitudinal studies with subjects of different ages of the period of interest. For example, in the first year they would measure three groups of children, one at 4 years of age, one at 6 years of age, and one at 8 years of age. Notice that if the researchers stopped here they would have a cross-sectional study. Instead, a year later they measure all the children again. This time the children are 5, 7, and 9 years of age. They do the same thing another year later, when the children are 6, 8, and 10. In the end they have done three small longitudinal studies: one cohort that was the original 4-year-olds at 4, 5, and 6; one cohort that was the original 6-year-olds at 6, 7, and 8; and one cohort that was the original 8-year-olds at 8, 9, and 10.

Thus, information is made available about ages 4 through 10, but only 2 years were needed to obtain it. What about the possibility of cohort differences? Note that the mini-longitudinal studies cover overlapping ages. Two groups were tested at age 6 and two groups were tested at ages 7 and 8. If performance of the different cohorts is the same at a given age, then it is likely that cohort differences are not present. If the cohorts perform differently at the same age, cohort influences might well be present. This type of design is called a **mixed-longitudinal, or sequential, research study**.

New students of motor development can tell whether a research study is developmental by considering the design of the study. The study is developmental if the

A **cohort** is a group whose members share a common characteristic, such as age or experience.

In a **mixed-longitudinal, or sequential, research study**, several age groups are observed at one time or over a shorter time span, permitting observation of an age span that is longer than the observation period.

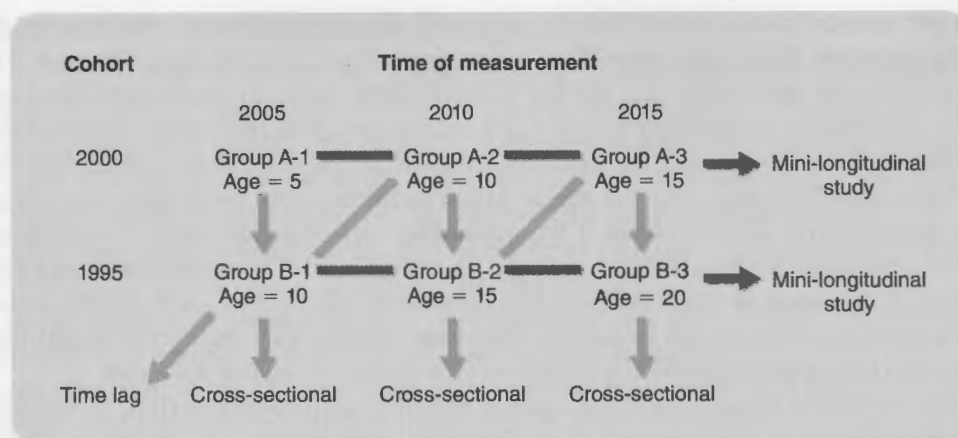


FIGURE 1.4 A model of a sequential research design. Note that each row is a short longitudinal study and that each column is a small cross-sectional study. The time-lag component of sequential research design, shown by the diagonal lines, allows comparison of groups from different cohorts but at the same chronological age, thus identifying any cohort differences. Ages 5 to 20 can be studied in 10 years—1990 to 2000.

design is longitudinal, cross-sectional, or sequential (figure 1.4). Research studies that focus on one age group at one point in time are not developmental.

A Developmental Paradox: Universality Versus Variability

Picture yourself in a gymnasium filled with preschool students. Many children move similarly: They begin to display rudimentary catching and throwing; they walk and run with proficiency but have difficulty skipping. On average, the children perform many of the same motor skills. Yet if you look at an individual child, he or she may move in more or less advanced ways than a child standing a foot away. This difference highlights the paradox of universality of development as opposed to individual differences (Thelen & Ulrich, 1991). Individuals in a species show great similarity in their development in that they go through many of the same (stereotypical) changes. You have heard reference to “stages of development.” Stages, of course, describe the emergence of universal behaviors. Those who anticipate working with individuals in a particular age range are often interested in the behaviors typical of those in that range.

However, individual differences in development do exist. Any individual we observe is more likely to be above or below average, or to achieve a milestone earlier or later than average, than he or she is to be exactly average. In addition, children can arrive at the same point in development by very different pathways (Siegler & Jenkins, 1989). All individuals, even identical twins, have different experiences, and people who work with any group of individuals supposedly at the same stage of development are usually amazed by the variability in the group.

Thus, developmentalists, educators, parents, and health professionals must consider an individual’s behavior in the context of both universal behaviors and individual differences. It is also important to recognize when others are using a perspective that focuses on the universality of behavior and when they are focusing on variability in behavior. Systematic and controlled observation—that is, *research*—helps us distinguish between behaviors that tend to be universal and behaviors that reflect human variability. Research also helps us identify the role

of constraints such as the environment and individual experiences in creating variability of behavior.

As much as possible, the ideas presented in this text are based on research studies; the information comes from an objective source. Keep in mind that this is not the same as saying that any one or two research studies provide us with all the answers we need. Individual research studies do not always rule out all the other possible explanations for the results—to do that, additional research might be required.

Deriving the principles and theories from research to guide educational and health care practice is a *process*. Although practitioners are sometimes frustrated to see that researchers are only in the middle of the process, it is better to recognize that this is the case than to take all research results as the final word. Our goal here is not only to use available research information to make insightful conclusions and decisions about the motor development of individuals but also to learn how to obtain and analyze further research information as it becomes available.



Think of generalizations we tend to make about people, such as “tall people are thin,” and then think of at least one person you know who is an exception to this “rule.” What is the consequence of expecting a student or patient to follow a generalization?

Summary and Synthesis

Now that we understand the developmental perspective, it is easy to see why a documentary series on motor development spanning several decades would be of interest to many viewers. At the present moment each of us is a product of “what we were like before,” and each of us will change to become something different in the future. We are all developing, and our individual constraints constantly change! Add changing environmental and task constraints and you have a very interesting mix related to motor development.

Many professions involve relationships with people at critical points of the life span—points at which the change taking place influences life thereafter. This is especially true in regard to the physical being and physical skills. As a result, your knowledge of motor development and the constraints related to it will help you and those around you throughout life. If you choose a profession such as teacher, coach, or therapist, this knowledge will help you help others by providing developmentally appropriate activities.

Your study of motor development will be easier if you equip yourself with a few basic tools. Most important is a framework or model to which you can relate new information, and we use Newell’s model of constraints throughout this text. Another important tool is knowledge of how research in motor development is designed, which helps you understand how researchers address developmental issues.

Yet another important tool, which we have yet to discuss, is knowledge of the various perspectives that developmentalists adopt as they approach their research. Because the same problem can be approached from many perspectives, it is valuable to know which approach is taken. The next chapter explores various approaches and discusses the theoretical roots of motor development.

 Reinforcing What You Have Learned About Constraints**TAKE A SECOND LOOK**

At the start of this chapter you learned about the *Up* series, which has been very successful in Great Britain and the United States. Viewers are interested in how the participants change over time as well as how they stay the same and in what factors (or constraints, as we now call them) influence their life trajectories. In other words, they want to see how the lives of these children (and later adults) develop. Just like viewers of these films, readers of this text will examine motor development interactively, considering the influences that individual, environmental, and task constraints have on an individual's movement skills over his or her entire life. It is important that the documentaries do not end (nor do they become less interesting) once childhood ends; rather, they continue because individuals continue to develop and change across the entire life span. For this reason, we adopt a life span perspective for motor development.

TEST YOUR KNOWLEDGE

1. How does the field of motor development differ from that of motor learning? What key perspective separates the two?
2. How do physical growth and physiological maturation differ?
3. Think of your favorite physical activity, exercise, or sport. Describe some of the individual (both structural and functional), environmental, and task constraints of this activity.
4. Why might a person planning a career in teaching children choose also to study older adults?
5. What are the differences between longitudinal research studies and cross-sectional research studies? What characteristics of each are used in sequential, or mixed-longitudinal, research studies?
6. What does it mean if a physical educator uses "developmentally appropriate" teaching practices? Provide some examples using constraints.

LEARNING EXERCISE 1.1***Searching the Internet for Information on Motor Development***

The Internet can be a valuable resource for any practitioner. Many organizations and advertisers provide information that anyone with a computer can access. It is important, however, to keep in mind that there are few regulations on the Internet; anyone can make almost any claim (whether it is based on research, opinion, or something else). You, as an informed consumer, must examine websites carefully and determine the usefulness and accuracy of their information, just as you would with library research. In this learning activity you will determine the theoretical assumptions and underpinnings of various websites.

1. Enter the term *motor development* into the search engine of your choice (e.g., Google, Bing). How many hits are there using these two words? Do any of the websites surprise you? How so?
2. Find a website that sells motor development products. Pick a product. What is it, and what is its purpose? How is it developmental, according to the advertiser? Based on what you've learned, is it *really* developmental?
3. Repeat your Internet search, adding the term *infancy* to *motor development*. From the resulting list, examine at least three types of websites (e.g., academic,

sales, medical). Identify some unusual or particularly interesting sites. If you were a parent searching for information, what could you learn from these websites?

Theoretical Perspectives in Motor Development

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Introduction

- 1. Theoretical perspectives in motor development
- 2. Theoretical perspectives in motor development
- 3. Theoretical perspectives in motor development