Miller (2011)

We have theories of development because observers of human behavior have been intrigued by what they saw children and adults do. A 3-year-old predicts that a crayon box holds crayons; then, after it is opened to reveal candles, he asserts that he always believed that it held candles. A 5-year-old claims that spreading out a row of buttons increases the number of buttons. A school-age child uses a good strategy to successfully solve an addition problem but shortly later she uses a less reliable strategy on the same problem. An adolescent selects an identity without seriously exploring other possible identities. An adult reports a dream that seems to be a thinly disguised attempt to deal with childhood anxieties.

Developmental theorists try to make sense out of observations such as these and, by doing so, construct a story of the human journey from infancy through childhood or adulthood. Some of the theories we will explore are grand, encompassing theories, often associated with a particular person, for example, Piaget's, Freud's, Erikson's, and Vygotsky's theories. Other theories actually are families of approaches under a general "theory" or framework, such as social learning theory, information processing, dynamic systems, and ethology and other evolutionary theories, and are not necessarily identified with a single person. Still other theories might be called "minitheories," for they limit themselves to a particular territory within development. An example is the "theory theory," which examines children's concepts about a domain, for example, the mind.

Some developmental theories are actually theories from areas outside of development that have been applied to developmental psychology, such as evolutionary theory, information processing, dynamic systems theory, and cultural psychology. Typically, a few key developmentalists see the potential of the theory for posing new questions about development or providing a new explanation of development and then translate the theory into a developmental framework. Thus, theory building in developmental psychology is a very rich, dynamic, and exciting enterprise that has come from many directions. The theories' stories are varied, but all give us insights into human behavior and change the way we look at the world.

This book attempts to convey not only the content of the theories but also the excitement and passion that developmentalists have felt as they constructed their theories or adopted those of others. In some cases certain observations, such as those described above, have captured the imagination of researchers and created a sense of excitement and progress in the field. They saw these intriguing behaviors as mysteries to be solved.

In other cases certain ideas have expanded our vision of the nature of development. For example, Piaget's idea that the mental operations of adults have their origins in the sensory-motor behaviors of infancy opened up a whole host of new ways to think about cognitive development. Each theory tells us something important about the fundamental nature of human development.

To understand the contribution of these developmental theories, we must first look at the general nature of theories. In this Introduction, we ask the following questions about theories:

1. What is a theory?
2. What is a developmental theory?
3. Of what value is a developmental theory?
4. What main issues of developmental psychology do theories address?

> What Is a Theory?

This is a deceptively simple question. In fact, a philosopher of science might "answer" our question by asking two more:

1. Are we asking what theories should be or what they typically are?
2. Are we asking about theories as they are stated formally or as they actually operate in a scientific community?

The philosopher's first question concerns the distinction between ideal and real theories and expresses the sad fact of scientific life that our theories fall short of their goal. Theories usually do not reach a complete, formal state. An ideal, complete, formal *scientific theory* is a set of interconnected statements—definitions, axioms, postulates, hypothetical constructs, intervening variables, laws, hypotheses, and so on. Some of these statements, which are usually expressed in verbal or mathematical form, are deduced logically from certain other statements. The function of this set of interconnected statements is to describe unobservable structures, mechanisms, or processes and to relate them to each other and to observable events. Perhaps the best way to contrast these types of statements is to show that they occupy different levels within a theory. That is, they vary in their distance from observable behavior. The "farther" a statement is from observable behavior, the less likely it is to be supported or refuted by empirical data.

At a point farthest from observable behavior are certain *assumptions* (axioms, postulates) that are accepted without being tested. (For example, in Piaget's theory, an assumption is that thinking is organized.) These

assumptions may be so self-evident to the theorists that they are not even aware of them. As we move to a less general level, we find *hypothetical constructs*—concepts that posit relations among events, objects, properties, or variables. These constructs (such as "mental scheme" and "mental reversibility" in Piaget's theory) are unobservable themselves but refer to behavior that can be observed. Theorists translate hypothetical constructs into testable *hypotheses,* which are tentative statements about the relations among events, objects, properties, or variables. (One Piagetian hypothesis is that the infant tends to repeat interesting actions, such as shaking a rattle.) A hypothesis becomes a *fact* when it is sufficiently supported by research. As facts accumulate, they are tied together by a *law:* a relatively well-established general statement concerning the relationship among a set of facts.

We build theories by going back and forth between *data* (repeatable empirical observations) and theory. New facts change the theory, and changes in the theory generate new experiments and thus new facts. The new facts again change the theory, and so the cyclical process continues. Empirical observations can provide strong support for a theory but can never completely prove that a theory is true because future observations could provide disconfirming evidence. In some theories, the theory does little more than summarize the facts (data). Particularly in Skinnerian learning theory, one finds statements such as "If a response is followed by a reinforcer for several trials, the frequency of that response increases." Such theories that stay close to the data are easier to test because they are easier to disconfirm. At the other extreme, Freud's "unconscious" or Piaget's "equilibration" process bears at best an uncertain and distant relationship to observable behavior. Because a large distance between theoretical notions and data makes it more difficult to test the theory, several such theories may be equally good at explaining the same set of data and thus may be retained for years, regardless of their accuracy.

Traditionally, psychologists have judged theories by certain criteria. A theory should be logically sound, that is, internally consistent, with no statements that contradict each other. A theory should also be empirically sound, that is, not contradicted by scientific observations. Furthermore, it should be clear, testable, and parsimonious, relying on as few constructs, propositions, and the like as possible. Finally, a theory should cover a reasonably large area of a science and should integrate previous research.

Psychology has had few formal theories in its history, and probably no current theory of development falls into this category. However, the

above requirements give us a context for judging whether each theory or model of development is headed in the right direction. We can ask whether each theory could eventually reach the status of a formal, testable theory. In their present form, developmental "theories" serve as frames of reference for examining changes in behavior over time. For example, Piaget's theory directs our attention to the organization of thought rather than to specific pieces of knowledge, to stagelike changes during development rather than to a gradual accumulation of knowledge, and to children's active construction of knowledge rather than to their passive processing of information.

Today, theorists often use the term *model*—an informal theory of more limited scope. Models sometimes are presented visually, for example, in a drawing of boxes and arrows to indicate the flow of information during thinking. Models also can be like analogies, as when the mind is likened to a computer.

The philosopher's second question distinguishes between theories as they are stated (in books such as this one) and how they actually operate in a scientific community. A theory, in its tidy and polished form in a textbook, bears only a faint resemblance to the way the theory guides the behavior of real people doing real research. This section on theory building has presented the conventional view of theory building—an orderly, objective, logical process. This is a picture of scientists in their "dress clothes." Although science sometimes does proceed in this way, more often it proceeds in a much messier, more irrational fashion to produce a polished final product.

More specifically, the conventional view of theory building implies that empirical observations are objective bits of information that we can use to make more general statements or to test statements derived from a theory. In reality, facts do not simply present themselves to eager scientists. When people develop or adopt a particular theory, they take on a whole set of beliefs concerning what questions about development are worth asking, what methods for studying these questions are legitimate, and what the nature of development is. A Freudian is not likely to study how rats learn to press bars in tightly controlled experiments, and a learning theorist is not likely to ask people to describe their dreams or memories of childhood. There are unwritten rules of the game that are very much a part of the theory as it is practiced. Scientists' assumptions lead them to see certain facts more easily than others. If theorists assume that humans are basically rational, they are more likely to study thought than emotions, more likely to become a Piaget than a Freud. In fact, it can be difficult to see what we are *not* looking for. As an illustration, radio

signals from Jupiter had been heard, but ignored, for many years before two young American astronomers "discovered" these signals in 1955 and recognized their significance.

Scientists make decisions about how to divide up the "stream of behavior" and how to describe it. A 1-minute episode of a baby playing could be described in thousands of ways. There are different levels of behavior, from heart rate to exploration of the room, and different temporal units, from a fraction of a second to a behavioral unit spanning perhaps the entire minute. Which facts or observations the psychologist chooses from the thousands of candidates tells us as much about the psychologist or her theory as about the episode of behavior itself. These constraints on what is observed are necessary, of course, because it is not feasible to record everything.

Some philosophers and psychologists are "social constructionists," who propose that science and its theories are one particular view of reality and are always filtered through social–cultural beliefs, values, language, and categories. A scientist's social and political beliefs can be especially biasing in a field such as psychology, in which people are studying people. The psychologist holds a mirror rather than a telescope.

Developmental psychologists do not escape their culture's views. Scarr argued that we change our scientific lenses as the culture changes: "We pose questions to fit our place and time; we get answers to fit our theoretical niches" (1985, p. 204). She noted that in the 1950s and 1960s social scientists expected, and thus looked for, evidence that boys in "broken homes" were affected negatively by the lack of a father. The finding that these boys, when young, were low in aggression was taken as evidence for poor sex-role development. Since the women's movement and the emergence of nontraditional families, it is no longer automatically assumed that nontraditional family situations have a negative effect on children. Moreover, with current less rigid views of desirable masculine and feminine traits or behaviors, low aggression in a boy may not be seen as a deficit.

"Feminist theorists" identify biases in science stemming from cultural beliefs about gender roles or the gender of the researcher (that is, that researcher's experiences due to being male or female). For example, a theorist could focus on mastery and independence from others or on connections and collaborations with others (Miller, 2000). Social constructionism and feminist theory are not embraced by most practicing researchers, but these critiques have alerted investigators to their own assumptions and biases, which can affect both their theory building and their research.

Individual psychologists' personality and motivations also influence the particular direction their research takes, a point demonstrated by learning theorist E. C. Tolman:

> I started out . . . with considerable uneasiness. I felt that my so-called system was outdated and that it was a waste of time to try to rehash it and that it would be pretentious now to seek to make it fit any accepted set of prescriptions laid down by the philosophy of science. I have to confess, however, that as I have gone along I have become again more and more involved in it, though I still realize its many weak points. The system may well not stand up to any final canons of scientific procedure. But I do not much care. I have liked to think about psychology in ways that have proved congenial to me. Since all the sciences, and especially psychology, are still immersed in such tremendous realms of the uncertain and the unknown, the best that any individual scientist, especially any psychologist, can do seems to be to follow his own gleam and his own bent, however inadequate they may be. In fact I suppose that actually this is what we all do. In the end, the only sure criterion is to have fun. And I have had fun.
>
> *(1959, p. 152)*

Still another example of the informal side of theories is that some theorists draw heavily on imagery, such as diagrams or metaphors, to communicate their theories. Connectionist models, discussed in a later chapter, often include diagrams of several layers of circles and arrows to depict brain networks and the strengthening of associations among mental representations. New technology brings new metaphors, as seen in the early images of the nervous system as a telephone switchboard, the eye as a camera, and an instinct as a hydraulic system, then later images of cognitive development as an equilibration system (Piaget), a computer (information processing), and a neural network (connectionism).

> What Is a Developmental Theory?

The preceding crash course in the philosophy of science suggests that developmental theories are somewhat informal frameworks at present and, like all theories, have a dynamic, nonpublic role as well as a static, public one. Our next question is: What makes these theories developmental? Simply studying children does not make a theorist a developmental theorist. For example, studying learning in 6-year-olds, or even children of several ages, does not necessarily lead to conclusions about development. What is critical about a developmental theory is that it focuses on *change over time*. Although developmental theories have nondevelopmental theoretical concepts such as ego, mental representations, and neural

networks, they diverge from nondevelopmental theories by emphasizing changes over time in these concepts. Moreover, developmental theories link change over time to what came before and what comes next. That is, a developmental theory attempts to explain *by what process* a phenomenon (a) emerged from prior development and (b) leads to subsequent development. For example, with increases in the number of representations that can be held in mind simultaneously and manipulated (developmental process), the new strategy of verbally rehearsing a list of items to be remembered may emerge from the prior skill of simply naming these items and may later join with other strategies to make memory even more efficient.

This concern with change presents developmental theories with three tasks. These tasks are (1) to *describe* changes *within* one or several areas of behavior, (2) to *describe* changes in the relations *among* several areas of behavior, and (3) to *explain* the course of development that has been described. Let us look more closely at each of these three tasks.

1 *A developmental theory describes changes over time in one or several areas of behavior or psychological activity, such as thought, language, social behavior, or perception.* For example, a theory might describe changes in the rules of grammar underlying language in the first few years of life. Although developmental theories tend to stress changes over months or years, an adequate theory must ultimately describe changes over seconds, minutes, and days. For example, the concept of object permanence, the notion that objects exist even when we do not see them, may develop over many months during infancy, but a full description would include many "mini-developments" that occur during the child's moment-to-moment encounters with objects.

As we noted earlier, even direct observation is guided to some extent by theoretical notions that distort the flow of behavior in some way. Observers record certain behaviors and ignore others. They divide the stream of behavior into units. They encode the behavior into words that add connotations. They allow inference to creep into their observations. The following descriptions of the same behavior demonstrate that several degrees of inference are possible:

a. The baby's hand came closer and closer to the spinning top.
b. The baby reached for the spinning top.
c. The baby wanted to pick up the spinning top.
d. The baby applied her grasping scheme to the spinning top. (A scheme, according to Piaget, is an organized sequence of behavior that reflects an infant's knowledge in a particular area, such as grasping.)

Much of the early work in developmental psychology was focused on description. In the 1930s, Arnold Gesell's maturational theory of development established norms of physical, cognitive, and motor development through description. Although description is not sufficient for an adequate theory of development, it certainly is necessary. Without a database, we have an "edifice without a foundation" (White, 1969, p. 49).

2 *A second task for a theory of development is to describe changes over time in the relations among behaviors or aspects of psychological activity within one area of development and, ideally, among several areas of development.* A developmental theory tries to deal with the simultaneous changes in thought, personality, and perception that we observe. Developmental theorists are "specialized generalists" in that they are knowledgeable about many areas of psychology but specialize in the developmental approach to studying these content areas and their relations.

In the case of the object concept described earlier, a theory might describe how the concept relates to children's developing memory system and their social relationship with one particular object, their mother. A theory would outline the temporal relations among these areas of development. For example, a theory might claim that a certain degree of memory capacity is developed before the object concept emerges, that the mother is the first permanent object, and that subsequent developments within the object concept are correlated with changes in the memory system and children's attachment to their mother. Another example concerns the relationship between thought and language. One position, that of the Russian psychologist Lev Vygotsky (see Chapter 4), is that thought and language are relatively independent until they merge to produce symbolic thought and children can think in words. Both examples describe the organization within children at various points in time. The descriptions refer to certain sequences (first *A*, then *B*) and concurrences (*A* and *B* at the same time) that occur during development.

Of course, any attempt to divide behavior into parts is somewhat arbitrary because there is an interrelated system, or the famous "whole child." Also, theories need to include the sociocultural context in any description, as well as the child, because behaviors occur in particular sociocultural settings. Nevertheless, not everything about the child and the environment can be studied at once. Developmentalists try to study the parts in the context of the whole child and the social and physical environment.

3 *Even if a theory provides a full description of development, it has not accounted for the transitions from point to point during development. Thus, a third task for a developmental theory is to explain the course of development that the other two tasks describe.* In fact, the sequences and concurrences identified in the first two tasks often suggest particular explanations. If skill A always appears shortly before the development of skill B, a psychologist may hypothesize that *A* causes *B*.

With respect to the third task, a developmental theory offers a set of general principles or rules for change. These principles specify necessary and sufficient antecedents for each change and identify variables that modify or modulate the rate or nature of each change. For example, Freud proposed that the biologically based drives "move" from the oral area to the anal and that the degree of the child's accompanying anxiety depends somewhat on the parents' child-rearing practices. In addition, principles of change hypothesize a set of processes for producing the change. These processes have been as diverse as dynamic equilibration in Piaget's theory, physical maturation in Freudian and ethological theory, and the strengthening of a response by reinforcement in learning theory.

One way to interpret developmental change is to hypothesize a continuity underlying the apparent change. For example, a theory might claim that dependency is expressed in different ways at different ages but that the underlying trait is the same. Or a theory might emphasize the underlying continuity in cognitive development by pointing to the gradual change in the understanding of number and by hypothesizing that what can be learned is limited by what number concepts the child already has. In more general terms, a theory may claim that concept, trait, skill, or behavior *A* is transformed into *B*, is replaced by *B*, combines with *B* to form *C*, and so forth. Most of the developmental theories we examine in this book posit an underlying continuity to the superficial changes during development.

When a theory explains why development proceeds in a certain way, it at the same time explains why certain other possible courses of development did not occur. Why did *A* lead to *B* rather than *X*? The significance of nonoccurrences is expressed by Sherlock Holmes:

> " . . . the curious incident of the dog in the nighttime."
> "The dog did nothing in the nighttime."
> "That was the curious incident," remarked Sherlock Holmes.
>
> —*Sir Arthur Conan Doyle*

These three tasks are not necessarily approached in the preceding order. A theory of development usually weaves back and forth among the three

tasks. Progress on one of the tasks stimulates progress on another, which in turn feeds back to the first task or the third. A related point is that description and explanation are not as separate and independent as the list might imply. A theory's explanatory concepts influence the choice of what is described and how it is described, and the type of explanation that theorists offer is somewhat constrained by how they have described behavior. Finally, developmental theories are not equally concerned with these three tasks. For example, Piaget was much more successful at describing the development of thought than at explaining this development.

These three monumental tasks, even if incompletely met thus far, provide us with goals by which to measure the success of current theories of development. A more realistic expectation for the near future is that we can have theories that succeed in a more limited way. Theories may successfully describe and explain one particular area of development, such as language development, but not all areas. Or they may cover several areas but only achieve one or two of the three tasks. For example, a theory might competently describe changes in several areas but unsuccessfully explain these changes.

> Of What Value Is a Developmental Theory?

What does a developmental theory actually do for us when it describes and explains development? A theory makes two contributions: (1) it organizes and gives meaning to facts, and (2) it guides further research. We examine each of these contributions in turn.

Organizing Information

The explosion of research on children in recent decades makes it especially important to look at current theories or develop new theories to make sense of our information about children. A theory gives meaning to facts, provides a framework for facts, assigns more importance to some facts than others, and integrates existing facts. Facts do not speak for themselves. As Jules Henri Poincaré (1908/1952) said, "Science is built up of facts, as a house is built of stones; but an accumulation of facts is no more a science than a heap of stones is a house." Just as stones need an architect or a blueprint to become a house, so do facts need a theorist to give those facts structure and show their relation to the overall design. One by-product is that by summarizing and organizing information, we

are saved from "information overload." It is easier (but perhaps more dangerous) for us to refer to "defense mechanisms" than to state all the separate behaviors to which they refer.

Just as the same stones can be used to make different houses, so can a set of facts be given different meanings by different theories—by organizing them differently, emphasizing different behaviors, and inferring different hypothetical constructs. Consider the following example (McCain & Segal, 1969): At one time, two theories explained the tendency of a falling rock to increase its speed as it approaches the earth. According to a popular Greek theory, rocks and earth like to be with each other because they are made of the same elements. As the rock gets closer to the earth, it travels faster because it becomes increasingly excited. The same fact can also be explained by Newton's theory of universal gravitation. All particles attract each other with a force directly proportional to the product of their masses and inversely proportional to the square of their distances. These two theories are based on the same set of observations, but they assign different meanings to these facts.

When we view development through the lenses of first one theory and then another, we experience a gestalt-like shift. We see the child as seething with sexual energy or reflecting on the origins of the universe. We see the child as a bundle of conditioned responses or a highly organized system. At times, we may wonder if we are looking at the same child in these different perspectives. These theoretical shifts have been likened to shifts in the perception of ambiguous figures (Averill, 1976), such as the sudden perceptual shift of young woman to old woman in Figure 1.1. The information has not changed, but our organization of it has.

Guiding Research

In addition to organizing and giving meaning to facts, a theory serves a second function. It is a heuristic device, a tool to guide observation and to generate new information. A theory's abstract statements predict that certain empirical statements should be true. These empirical statements then must be tested. Theories sometimes stimulate new observations. For example, ethology, an approach borrowed from biology, stimulated developmental psychologists to search for innate social behaviors contributing to the adaptation of the species to the environment. A new theory may also cause us to reexamine familiar behavior. Piaget certainly was not the first person to watch babies play, but he suggested a new way of looking at this behavior: The actions themselves are creating thought, according to Piaget.

FIGURE 1.1

Similar to the shift in perspective from one theory to another, the lines in this drawing can be perceptually organized to form an old woman or a young woman.

Theory's dual role as a stimulator and interpreter of data is nicely illustrated in a 22-year longitudinal study of aggression (Eron, 1987). Traditional learning theory, with its emphasis on drive reduction, guided the selection of the original variables in 1960. In later years, as new learning theories emerged, investigators interpreted the data first in terms of Skinnerian operant learning (early 1970s), then social learning (mid-1970s), and finally cognitive theory (mid-1980s). Thus, in these four phases of learning-theory development, investigators sought the causes of aggression in frustration (drive reduction), reinforcement of aggression (Skinner), aggressive models (social learning), and finally the child's attitudes toward and interpretation of potential instigators of aggression (cognition).

> What Main Issues of Developmental Psychology Do Theories Address?

Although the theories to be covered differ in their content, methods of investigation, and formal nature, all explicitly or implicitly take a position on certain core issues of development. Developmental change, by its very nature, leads to at least four critical issues:

1. What is the basic nature of humans?
2. Is development qualitative or quantitative?
3. How do nature and nurture contribute to development?
4. What is it that develops?

These issues, which serve as a way of summarizing and contrasting the theories, reappear at the end of each chapter. First, however, some discussion of each issue is in order.

What Is the Basic Nature of Humans?

Theorists' views of development are closely tied to their views of human nature. Their views of human nature, in turn, are closely tied to their worldviews, or their notions about how the universe works. Philosophers of science have identified several worldviews in the history of the Western world (Pepper, 1942). Three of these can be found in theories of developmental psychology (Overton, 1984; Reese, 1991): the mechanistic, the organismic, and the contextual. We examine each of these.

In the *mechanistic* view, the world is like a machine composed of parts that operate in time and space. For example, the world could be likened to a watch. Forces are applied to the parts and cause a chain reaction that moves the machine from state to state. In principle, then, complete prediction is possible because complete knowledge of the state and forces at one point in time allows us to infer the next state. The mechanistic view has its roots in Newtonian physics. It is also related to the empiricist philosophy of Locke (1632–1704) and Hume (1711–1776), which pictures the human as inherently at rest—a passive robot, motivated by environmental or bodily sources. Development, consequently, is caused by antecedent (prior) forces and events acting on a passive, machinelike mind composed of interlocking parts. One can almost see the wheels turning in the child's head!

In contrast, the *organismic* worldview is modeled on living systems, such as plants or animals, rather than machines. This image derives from

Leibniz (1646–1716), who believed that substance is in "a continuous transition from one state to another as it produces these states out of itself in unceasing succession" (Cassirer, 1951, p. 29). Leibniz pictured the world as composed of organized "wholes" that are inherently and spontaneously active and self-regulating. This organization and self-directed activity is necessary, or natural, given the nature of the organism. This view emphasizes the whole rather than its parts, the relations among the parts, and how the whole gives meaning to its parts. In the realm of psychology, for example, one can understand a child's behavior only by viewing it within a larger dynamic system that includes the context as well as the child.

Rather than look for antecedent causes, as the mechanistic worldview has done, the organismic view considers inherent properties and goals. The human, by nature, is an active, organized whole and is constantly changing, not randomly but in a particular direction. Development, then, is inherent in humans. New skills emerge as humans mature and engage with the world. Self-initiated behavior and thought lead to changes in both the structure and the content of behavior and thought. White describes an active organism:

> Let us define an active organism as one that gives form to its experience, a passive organism as one that receives form from its experience. Active organisms have purposes and they attend, reason, and selectively perceive. All this enables the active organism to select, modify, or reject environmental influences pressing upon it.
>
> *(1976, p. 100)*

The organismic view is that children "construct" their knowledge by actively formulating and testing hypotheses about categories of objects and the causes of events. In contrast, the mechanistic view is that children passively acquire ("soak up" like a sponge) a copy of reality. Organismic, unlike mechanistic, theories often posit qualitative rather than gradual change, and sometimes they are stage theories.

In the third worldview, *contextualism,* the main metaphor is not a machine or a living system but a historical act or a tapestry. A behavior has meaning (and can be "explained") only in terms of its social–historical context. Pragmatist philosophers such as William James and George Herbert Mead provide the philosophical inspiration. As Pepper describes contextualism:

> [It] takes for its root metaphor the textured event, with its richly qualitied strands fading into a past that dies and guiding the changing pattern of a present duration into a future that dawns. The event through its tex-

> ture extends sidewise in its present duration into neighboring contexts which are themselves textures extending into still other contexts. And the texture of each event is internally analyzable into strands, which have individual tensions and references into other textures.
>
> *(1934, p. 183)*

This tapestry extends from the distant past to the distant future and from the proximal to the distal. The horizontal temporal and vertical spatial threads intermesh into a pattern of a human life.

We study this tapestry of development by looking at ongoing action-event units consisting of meaningful goal-directed activities. As Reese explains it, "Writing is not an act; but writing something with something on something in some situation at some time is an act" (1991, pp. 191–192). Reese lists other components of the contextual metaphor: The meaning of a behavior varies from context to context; a math problem may involve feelings of competence in the school environment but survival for a homeless child who is a street vendor. Moreover, behavior has a purpose that reaches into the past (some proximal "cause") and into the future (some goal). Finally, like the organismic view, the contextualist view is wholistic. Not only is a unit greater than the sum of its parts, but a unit-in-context is greater than the sum of a unit *and* its context. To continue the previous example, writing a sentence "is an act but is also a part of the larger act that includes writing about the act of writing the sentence, which in turn is part of the larger act that includes writing an entire paper, which in turn is part of the larger act that is the writer's lifetime, which in turn is part of the larger act that includes others' lifetimes, etc." (Reese, 1991, p. 194).

Thus, the contextualist belief that children's patterns of development can differ from one culture, subculture, or historical time to another contrasts with the mechanistic and organismic focus on universal laws of behavior and development. The main mechanistic approach, learning theory (Chapter 5), posits laws of learning, such as the influence of reinforcement on behavior, that apply across time and place. A main organismic theory, Piagetian theory (Chapter 2), proposes universal stages and mechanisms of development. As will become clear in subsequent chapters, these worldviews ask different questions about development and use different methods to answer those questions.

In addition to these three metaphysical views of humans, the world, and causality are more specific and limited views based on particular economic and political ideologies. For example, Riegel (1972) relates views of child-

hood and of development to the capitalistic and mercantilistic politicoeconomic systems in the seventeenth to nineteenth centuries.

The capitalistic system, largely Anglo-American, saw humans as competitive, as struggling for success. Thomas Hobbes's (1588–1679) pronouncement of humans as selfish and competitive and of life as "nasty, brutish, and short" expressed this notion. The roots continue through Charles Darwin, who stressed the survival of the fittest. In the economic arena, the emphasis was on free trade, competition, and entrepreneurship. The standard of success (as a result of struggle and competition) was the white, middle-class adult male engaged in manufacturing or business. By this standard, children, the elderly, the mentally retarded, and women were considered inferior. Childhood, considered a state of incomplete adulthood, was a "disability." Normative descriptions of each age were developed to detect "abnormal" development and chart children's progress toward the adult standard of success. Society saw children as passive beings who must be molded ("socialized") into appropriate adult roles.

The mercantilistic ideology, in contrast, existed primarily in continental Europe in the seventeenth through the nineteenth centuries. The economy was based on land ownership and state-controlled trading more than on manufacturing and free trade. Distinct social classes enjoyed specified duties and privileges, and little competition between classes occurred. Society emphasized cooperation more than competition; differences between groups were tolerated. The main philosophical spokesman, Jean Jacques Rousseau (1712–1778), saw the child as a "noble savage," basically good but ruined by the adult world. Children were not to be judged by adult standards; children and adults were seen as qualitatively different. From this point of view, the goal of education was self-realization. Consequently, a child-oriented education was developed by Maria Montessori, Eduard Spranger, and others.

From even this brief account of changing history, it is easy to see how each theory of developmental psychology always has a view of humans that reflects philosophical, economic, and political beliefs. This view is often implicit, and sometimes theorists themselves are not even aware of these assumptions. The view influences not only theory construction but also decisions about which research problems are meaningful, what method should be used, and how data should be interpreted. Even the meanings of the terms "explanation" and "fact" are different in theories with different worldviews. For these reasons, it is sometimes claimed that it is impossible to integrate or reconcile

theories or make crucial tests that support one or the other if they have different worldviews.

Is Development Qualitative or Quantitative?

Closely related to these views of humans is the issue of the basis of developmental change: Is it qualitative or quantitative? The mechanistic and capitalistic views emphasize quantitative change, the organismic and mercantilistic approaches emphasize qualitative change, and contextualism permits both. Qualitative changes are changes in kind or type. An example from nature is the following sequence: egg → caterpillar → cocoon → butterfly (Spiker, 1966). New phenomena or characteristics emerge that cannot be reduced to previous elements. Qualitative changes typically involve changes in structure or organization. In contrast, quantitative changes are changes in amount, frequency, or degree. In some cases, the behavior becomes more efficient or consistent. The change is gradual and occurs in small increments. Bits and pieces of knowledge, habits, or skills are acquired during development.

An example of the contrast between quantitative change and qualitative change can be found in the development of memory. If a 4-year-old can recall three objects and a 7-year-old can recall seven objects from a set of objects seen several minutes earlier, we might infer a quantitative difference in their mental functioning. The older child can remember more. However, if the 7-year-old uses strategies such as sorting the objects into categories of food, furniture, and toys, and rehearsing them, whereas the 4-year-old does not, we would infer a qualitative difference in their mental functioning: They process the information in different ways.

At a more general level, the issue of qualitative versus quantitative change becomes an issue of stage versus nonstage development. When there are similarities in a number of new abilities or behaviors during a period of time, a theorist often infers that the child is in a particular "stage." For example, Piaget posited stagelike qualitative changes in the structure of thought from birth to adolescence. Stage theorists disagree about the possibility of being in more than one stage at the same time in different domains or of regressing to an earlier stage, and they argue about what causes children to differ in how quickly they pass through the stages.

Stagelike qualitative changes have been identified by scholars other than developmental psychologists. Historians identify periods in history, such as the "industrial age" or the "age of reason." Shakespeare saw seven

ages of man from the "mewling and puking" infant to the old person "sans teeth, sans eyes, sans taste, sans everything."

It is surprisingly difficult to tell when developmental change is quantitative versus qualitative. The problem is that change may look abrupt and qualitative if long time intervals separate the times that behaviors are sampled and quantitative if short time intervals are used. For example, when infants' motor skills are observed once per month, infants usually appear to progress abruptly from not having a skill to having it (e.g., from standing to taking a step), but daily observation reveals a more gradual quantitative change, with the new skill gradually strengthening and becoming more stable (Adolph, Robinson, Young, & Gill-Alvarez, 2008).

Some behaviors show both qualitative and quantitative changes, perhaps even alternating during development. For example, one might find that an increase in mental capacity (quantitative change) may facilitate the development of a sorting strategy (qualitative change). Subsequent increases in the speed and accuracy of this sorting would involve quantitative change.

Currently, the debate over quantitative versus qualitative development focuses on two issues. First, what is the exact form of the developmental trajectory of some skill (Adolph et al., 2008)? As described earlier, some trajectories are quantitative and linear, as when a child gradually acquires more words with increasing age, and some are qualitative and like stair steps, as when a child goes through stages. More interesting are more complex trajectories, such as a period of slow quantitative increase in vocabulary development followed by a somewhat sudden vocabulary spurt that later levels off to a slower gradual increase, or a U-shaped course of development in which acquiring a new rule, such as adding "–ed" to form the past tense leads to errors, such as "goed," but eventually leads to a rule with exceptions ("went"). In this latter case, there seems to be a temporary regression in that performance seems to get worse, then better. In short, depicting changes in quantitative and/or qualitative development becomes more complex when the rate of change and the positive or negative direction of change are considered as well.

Second, the quantitative-qualitative issue emerged again recently in a discussion (Liben, 2008) of what it means when infants seem to have certain adultlike competencies "that need merely to be triggered and sharpened by contact with the world" (p. 1600). An example is infants' apparent understanding of categories such as "cats," "females," and number that are not so different from those of adults. If infants truly have this ability, then most of development in these domains after infancy neces-

sarily would involve only modest quantitative change as the concept simply strengthens. The debate continues.

How Do Nature and Nurture Contribute to Development?

Regardless of the extent to which development is qualitative or quantitative, a theorist must refer to the causes of development. The basic issue is how knowledge and behavior arise from one's genetic endowment and physical maturation and from experience in the world. The nature–nurture issue is known by several other labels, such as "heredity versus environment," "nativism versus empiricism," "biology versus culture," "maturation versus learning," and "innate versus acquired abilities."

This controversy has raged not only within psychology but also within philosophy. The controversy began in classical Greek times when philosophers asked whether ideas are innate or acquired through the experience of the senses. Later, Descartes (1596–1650) believed that certain ideas are innate, while the British empiricist Locke (1632–1704) argued that the newborn's mind is a blank slate (*tabula rasa*) on which experience writes.

Within psychology, the question has changed over time. The original question was "*Which* (heredity or environment) causes a behavior, or *how much* of each is needed for a given behavior?" This question was replaced by "*How much of the variation* in a behavior across people is due to hereditary differences and how much to environmental differences?" and "*How* (in what manner) do nature and nurture interact to produce development?" Recently, the questions have become "*Which* genes predispose to *which kinds of* behavior?" and "*What* are the environmental triggers for the expression of these genes, and *how* do these triggers have their effect on genes?" This is an interesting illustration of how progress in a field sometimes simply means learning how to ask the right question.

Today it is clear that a complex interaction of innate and environmental factors accounts for both the development of a trait or behavior in an individual and the variations in a trait or behavior among individuals. Nature and nurture are inextricably intertwined. Both nature and nurture are fully involved in the development of any behavior. Hebb (1980) remarked that behavior is determined 100 percent by heredity and 100 percent by environment. Genes (specifically, particular sequences of DNA) are never expressed directly in behavior. There is a long chain of events involving genes, physiological processes, and the prenatal and postnatal environment. The intertwining of nature and nurture can be complex and subtle as when genes predispose children to seek particu-

lar kinds of environments. For example, an innately active, exuberant child and a passive, quiet, reflective child select different types of play settings and playmates. Thus, they are exposed to different types of experiences. As another example, genes and the environment can be correlated, as when shy parents both pass on a tendency toward shyness genetically and provide an environment that encourages shyness. Pennington et al. (2009) provide other interesting examples.

The nature–nurture issue is at the center of two of the most active and exciting current areas of research: gene × environment interactions and cognitive neuroscience. Gene × environment interactions refer to (a) environmental effects that moderate genetic influences or (b) genetic variation that affects a person's sensitivity to particular environmental influences, including interventions. In other words, experience affects gene expression, and genes affect how a child experiences a particular environment and the effect of a particular experience. A given hereditary influence can have different behavioral effects in different environments, and, conversely, a given environment can have different effects on people with different genetic makeups. Such research has exploded due to the work on mapping the human genome, advances in molecular genetics, and the greatly increased accessibility and low cost of analyses of individuals' genetic makeup through, for example, analyses of saliva. Thus, the expression of genetic predisposition in different developmental contexts can be assessed.

An example of gene × environment research showing that the environment moderates genetic influence is a study (Brody, Beach, Philibert, Chen, & Murry, 2009) of "genetic risk," which refers to some children being genetically at risk for certain behavioral problems. In a sample of rural African-American 11-year-olds, some had a genetic makeup known to produce abnormal levels of serotonin for transmitting neural impulses in the brain and some did not. This particular makeup is known to be linked to high risk-taking. Those genetically at risk showed twice as much high-risk behavior (e.g., drug use, sexual behavior) as those not genetically at risk. This shows the importance of genetics. However, the at-risk preadolescents whose families participated in an intervention aimed at strengthening families by teaching parenting skills (e.g., vigilance, emotional support) and improving parent–child communication gained some protection from this genetic predisposition; they showed fewer high-risk behaviors over the 2-year period and in fact at age 14 looked very similar to the group not at genetic risk. Thus, this intervention moderated gene expression, and it was the combination of genetic and environmental risk factors that predicted the course of development. The same

genetic makeup was expressed in different behaviors in different types of family environments—those with and without the intervention.

An example of gene × environment research showing that genetic variation affects a person's sensitivity to particular environmental events comes from a study of genetic factors and adult attachment (Caspers et al., 2009). The effects of losing a parent early in life depended on interindividual variation in a gene regulating the production of the neurotransmitter serotonin. Children having one version of the gene tended to have unresolved attachment issues in adulthood, whereas those having the other version had some protection against this potentially devastating environmental event, perhaps because serotonin modulates negative emotional responses to environmental stressors. Thus, the same experience affected different people differently due to their genetic makeup.

One useful way to think about gene × environment interactions, particularly the expression of genes, is to liken a person's DNA to a large, organized library of books:

> Asking what DNA does is like asking what a book in this library does. Books sit on a shelf waiting to be read. Once read, the information in those books can have limitless consequences and can perhaps even lead to the reading of more books, but that refers to the book's potential. Likewise, DNA sits in our cells and waits to be read. The reading or so called "expression" of DNA can, like the books in our library, have limitless consequences. However, without the active process that triggers "expression," this potential may never be realized.
>
> *(Champagne, 2009, p. 27)*

Just as certain books are blocked or easily reached, both the environment and regions that regulate DNA can block DNA or make it accessible, thus affecting how easily DNA is expressed. The environment often provides, or does not provide, the trigger. Ineffective parenting, stress, poor nutrition, and the social environment, such as peer pressure to experiment with drugs, are all examples of triggers. In this way, experience affects the expression of genes. Developmental psychology takes center stage in this work because whether a particular experience is a trigger often depends on the child's age and developmental history (for example, prior nutrition, stress, or cuddling). For instance, the failure of mother rats to sufficiently handle and lick their offspring early in life alters the regulatory areas of the offspring's genome, causing long-term abnormal responses to stress (Champagne et al., 2006). Moreover, the offspring, as adults, pass on these abnormal gene regulation conditions to their own offspring, and the cycle of neglect and abnormal reactivity to stress continues into the next generation.

The second current boom area addressing nature–nurture, cognitive neuroscience, was stimulated by new technologies of brain imaging that generate maps of brain activity. Changes in blood flow (in fMRIs), metabolic activity in the cerebrum, or electrical activity provide these images. For example, researchers place sensitive electrodes on the scalp, which measure the electrical activity generated by the firing of groups of neurons. In this way they identify the pattern of the activity when, for example, a picture or sound is presented. Thus, one could compare the spatial patterns of brain activity in children of different ages or ability levels working on the same task or those of children of the same age working on different sorts of tasks. Such comparisons provide clues about developmental changes in cognitive processing and about the relations among different cognitive processes. Neuroimaging initially focused on the particular region of the brain associated with particular cognitive activities, emotions, or behaviors. More recently, attention has turned to "neural networks" that may involve several regions.

Brain development used to be considered a static unfolding of the genetic blueprint. Modern neuroscience, however, views brain development as a complex interaction of nature and nurture. Behavior affects brain development, just as brain development affects behavior. For instance, some evidence suggests that there are slight initial brain constraints or biases in that, for a particular task and situation, some neural pathways are more easily activated or more easily connect to certain outputs. Examples are infants' biases toward looking at faces or analyzing language sounds. However, infants in turn seek out these appropriate stimuli, which further strengthen and specialize these pathways (Johnson, 2000). Thus, infants may be slightly biased to look at particular types of stimuli, but the small biases become further amplified through specialized activity. The outcome is specialization of brain pathways, because the infant does not use the other pathways that initially could have been used.

The complex relations between biology and experience can be seen in the biologically driven overproduction of synapses early in development and also the pruning away of certain ones because they are not stimulated by experience. Most children, because they are physically normal and are raised in an environment typical for the species, have more or less the same sorts of experiences at about the same time. Thus, the pruning proceeds along similar lines for most children. However, what about atypical situations, such as children who are deaf or blind and thus do not receive auditory or visual stimulation? In deaf children, certain areas of the brain that normally would be devoted to auditory processing if the brain received both auditory and visual stimulation instead

gradually become devoted to visual processing (Neville, 1995). Conversely, in blind children, areas normally devoted to visual processing when receiving both auditory and visual stimulation instead are devoted over time to auditory processing. Thus, when an area of the brain does not receive its normally expected input, it can be used for other purposes. The nature of experience, and consequently the nature of brain activity, determines which synapses are pruned and which survive. The brain is preset to rapidly guide children along certain developmental paths, but it is also flexible enough to deal with adverse circumstances. Thus, much cognitive neuroscience research is about brain plasticity as much as brain determinism of behavior.

Genetic and neuroscience research are coming together in fascinating ways. Genes affect behavior through the developing brain. For example, genomic variation influences neural circuitry, as when specific genes lead to altered brain structure and function that predispose people to antisocial behavior (Raine, 2008).

The theories presented in this book differ in whether they emphasize the nature or the nurture part of the interaction. In addition, they disagree about the process by which either environmental or innate factors have their influence. For example, the environment can "stamp in" associations, provide models to be imitated, supply information to be assimilated, strengthen neural networks, or provide a supportive social system (a helpful parent). Finally, theories differ in how much importance they place on the timing of a particular experience. Are there "critical periods" in which the child is especially sensitive to a particular experience? Is early experience more influential than later experience?

What Is It That Develops?

Each theorist makes a claim concerning the "essence" of development, or at least the proper unit of analysis. Throughout this book, we encounter various phenomena, such as cognitive structures, psychic structures (id, ego, superego), strategies of information processing, neural networks, fixed action patterns, perceptual exploration, mental modules, and cultural tools. What theorists see as the essence of development depends on where their theoretical assumptions and methods of study place them along several dimensions:

1. Their level of analysis (from cells to societies)
2. Whether they focus on structure (organization of behavior, thought, and personality) or process (dynamic, functioning aspects of the system)

3. What content they emphasize (for example, personality or cognition)
4. Whether they emphasize overt behavior or covert thought and personality
5. What methodology they use to study development

These five dimensions have a chicken-and-egg relationship: Which came first, ethologists' decision to study complex behavior acquired by species in their struggle to adapt to the environment or their choice of a methodology, namely, observations in natural settings? This interrelationship among the dimensions will become more obvious as we examine each theory.

> SUMMARY

The traditional view of an "ideal" scientific theory is that it should be a hypothetico-deductive system and include a set of logically interconnected statements. It formally describes psychological structures and processes and relates them to each other and to observable events. Most psychological "theories," however, have failed to reach this level of formality. A theory has not only a public, formal, static nature but also a private, informal, dynamic nature. Moreover, a theory guides the behavior of psychologists doing research. It helps them formulate questions, choose what to study, and decide how to study a problem.

We need developmental theories. They help us describe and explain developmental changes by organizing and giving meaning to facts and by guiding further research. Developmental theories have taken a stand on four issues that are of special importance to the study of development:

1. What is the basic nature of humans?
2. Is development qualitative or quantitative?
3. How do nature and nurture contribute to development?
4. What is it that develops?

We now have a framework for viewing each of the theories in turn.

> ORGANIZATION OF THIS BOOK

The following nine chapters describe the major theories of development plus several minitheories. The focus is on infancy, childhood, and adolescence, though later development receives some attention. Piaget's theory is presented first because many of the current issues in developmental psychology were raised by his theory and several theories arose

in reaction to his theory. Next come the other two big theories in the history of developmental psychology: psychoanalytic and Vygotskian/sociocultural. The next four theories—social learning, information processing, ethology, and Gibsonian perceptual learning—came to developmental psychology more recently.

Chapter 9 describes several emerging, influential approaches, and the final chapter looks both backward and forward regarding developmental theories. Each chapter follows roughly the same organization, in order to make comparisons among the theories easier. At the end of each chapter, theories are evaluated in terms of their strengths and weaknesses according to the current state of developmental psychology. That is, we ask what each theory can contribute to today's developmental researchers, professionals who work with children, and parents.

> SUGGESTED READINGS

Lerner, R. M. (Ed.). (2006). Theoretical models of human development. Vol. 1 in W. Damon & R. M. Lerner (Series Eds.), *Handbook of child psychology* (6th ed.). New York: Wiley. Several chapters examine the philosophical foundations of developmental theories, the notion of development, the intellectual history of the field, and issues of development.

Liben, L. S. (Ed.). (2008). Continuities and discontinuities in children and scholarship [Special section]. *Child Development, 79(6)*, 1600–1658. This interesting exchange among major developmental researchers addresses the four issues of development described in this chapter.

Adolph, K. E., Robinson, S. R., Young, J. W., & Gill-Alvarez, F. (2008). What is the shape of developmental change? *Psychological Review, 115*, 527–543. This article describes various possible developmental trajectories.