

Chapter: Early Development: From Creation to Adolescence

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Early Development: From Creation to Adolescence

WHAT'S THE ANSWER?: From Conception to Confusion

"Last summer I served as a senior counselor in a summer camp up at the lake. Late one evening I was writing a letter to my girl friend when the biggest spider I've ever seen dropped into view. I decided to play a dirty trick on him. The spider was weaving the circular part of his web, so I unhooked that first strand from the porch floor and part of the web shriveled up. You know what that spider did? He started all over again! -- when all he had to do was anchor one more support and go right on." *Why did the spider start its web from the beginning?*

"Marcia's parents both have brown eyes," she said.

"That's not possible," he said. "Marcia has blue eyes! Brown-eyed parents can't have blue-eyed children." *Who's right? He or she?*

"My sister and brother-in-law had a baby girl about a month ago. Last night when I was playing with their baby I put my index fingers in her hands. When I moved my fingers, she didn't let go. In fact, I lifted her right up off the blanket! My sister was there to catch her if anything had happened. But I really don't understand it. That baby can't even hold her own bottle, but she's strong enough to hold herself up in mid-air!" *What did happen here?*

Developmental psychologists study changes in human behavior as they relate to age -- ranging from developmental changes in the early years to those of adolescence, adulthood and our retirement years. Most studies observing developmental changes in human behavior are trying to describe the behavior and to explain it -- the ultimate goals of developmental psychologists. The usual research techniques offer partial solutions to problems caused by the changing environments of youth during the past century. To control this problem developmental psychologists use methods such as longitudinal and cross-sectional studies, taking care to select groups at each age that are as comparable as possible.

Maturation involves changes in behavior due to physiological growth. Development includes all changes in behavior related to aging. There are two major groups of factors that influence our behavior. One is the heredity. The other source is environment, which provides a certain range of experiences. Our physical environment and social environment -- both within the family and beyond the family -- combine with hereditary factors to influence our behavior. Ultimately our behavior is determined by the interaction of heredity and environment.

From studying animals, psychologists have identified a number of forms of behavior, ranging from simple to complex. Ethologists have identified a number of processes in animal behavior that also apply to humans. These include taxis, reflexes, and instinctive responses as well as more complex responses based on learning and reasoning. Maturation and development proceed in humans in definite sequences. Human behavior changes from mass-action toward differentiation, and from simple toward more complex.

Concerning human development DNA-carrying genes combine to convey dominant and recessive characteristics to the new organism. During the prenatal period, a mother may unknowingly

injure the neonate or fetus by ingesting certain substances. The fetus can already react to stimuli which come from outside its mother. The process of birth seldom causes any damage to the infant.

During the first two years of life a baby is considered an infant. During this time humans experience one of their most rapid periods of change in body size and proportion, and motor skills develop quite rapidly. Although possessing a wide range of functional sensory organs, the infant gains much skill in interpreting incoming messages. Hand preference begins to develop, and the infant learns to stand and walk. Meanwhile, starting from random emission of sounds and progressing through babbling, telegraphic speech, and the error of over-generalization, the infant's language develops (even by age one) begins to communicate with a clearly developing self-concept.

During childhood, which stretches roughly from two to twelve years of age, a child experiences a moderate amount of body growth and increases in motor skills. Significant motor skill is gained both in motor coordination and in accomplishing more and more refined tasks; strength, reaction time, and balance also improve. Knowledge of a child's developing body and skills is especially helpful in fulfilling one's role as a parent. During early childhood language develops with the remaining classes of words being mastered. During the latter half of childhood, vocabulary size is increased. The self-concept undergoes marked development. Social experiences in playing with peers help children learn acceptable ways to behave.

The Review Questions will help with mastery of the materials covered in this chapter. After reading the chapter you may be interested in trying some of the suggested ACTIVITIES. Further information about selected topics within this chapter is available in follow-up readings suggested in the INTERESTED IN MORE? section.

Observing Behavior

Especially in the study of early development -- particularly before children's language is well developed -- psychologists emphasize the observation of behavior. Suppose you're waiting for a bus. At the bus stop with you are a very heavy woman, burdened with packages, and a mother with her two-year-old daughter. When the bus arrives with standing room only, the child pipes up loudly "Is that fat lady going to get in the bus?" Although the mother is no doubt embarrassed, probably neither you nor any of the other adults are surprised

by the child's tactless question. You attribute it to the youth of the child.



Suppose you're waiting for a bus. This time waiting with you are the heavyset woman and a woman accompanied by her twenty-two-year old daughter. When the crowded bus arrives, the daughter asks loudly "Is that fat lady going to get on the bus?" How do you react? You probably look shocked. You expect a person of that age

to keep her thoughts to herself or even offer to help the burdened woman. You attribute the 22-year-old's remark to uncontrolled, antisocial behavior.

Now suppose you're waiting for the bus, but this time waiting with you and the heavyset woman are an eighty-two-year-old woman and her daughter. When the crowded bus pulls up, the elderly woman asks, "Is that fat person going to get on the bus?" What is your reaction? You are probably tolerant of the outspoken old woman. You may understand that she could feel threatened at the thought of being crushed in the crowd and is unable to conceal her anxiety. You may even attribute her remark to her senility.

From this simple example we can note several points about human behavior:

- (1) We all constantly observe the behavior of those around us.
- (2) We often base our own reactions to others on very limited information.
- (3) We often make assumptions about other human beings based on these limited observations.

In all three scenes at the bus stop, only one independent variable differs: the age of the person speaking. Yet your behavior, the dependent variable, probably differs in each case. Your reactions demonstrate that as humans age, the behavior expected of us changes. What is appropriate behavior at one age is inappropriate at another.

That's the essence of developmental psychology: the study of human behavior as it relates to age. Developmental psychologists are concerned with the lawfulness, or predictability, of human behavior. With enough scientific information about a person, they try to predict how a person will behave at certain ages and in certain situations. This leads us to examine the goals and methods of developmental psychologists.

Goals of Developmental Psychologists

In the context of observing behavior, the earliest studies of age-related changes in human behavior date back 2,000 years or more. For many years it has been recognized that both heredity and environment influence how we develop. Yet, only since the 1930's or so have we begun to make real progress in our understanding. All of the earliest studies of human behavior were descriptive.



Scientists observed behavior as it occurred and then described it precisely. These illustrations, for example, are only descriptive. They are based on careful observation of changes occurring as an infant begins to coordinate muscles and, eventually, to walk. Today, developmental psychologists seek



not only to describe behavior but also to explain it -- a far more difficult goal. Psychologists do this by trying to identify the important independent variables that influence changes in our behavior as we grow older. Watch carefully as you read within this chapter. See if you can identify for yourself when a behavior is being described and when it is being explained.



If you think about it, you'll realize that when studying developmental changes, the presence of age as a "nuisance" variable is inevitable. Older people didn't grow up in the same environment as younger ones. For example, first, it is likely



your grandparents didn't eat food of the same quality and variety that you do. They probably had poorer schooling and fewer medications with which to treat diseases. Second, you are likely to be better educated at your age today than your grandparents were when they were your age.

Our system of education is better, and more sources of knowledge—from e-mail to television to the Discovery channel—are readily available. In short, the environment of many elderly people during their childhood was probably not as good as the typical environment of most children or adolescents today. So if a psychologist found in a study that older people differed from young people, what was the cause? Age? Or was it the different environments of childhood? We've got a confounding variable here. Controlling for confounding variables in studies of development is usually accomplished in one of two ways, using either a longitudinal or a cross-sectional study -- both examined in the methods of developmental psychologists.

Methods of Developmental Psychologists

Pursuing the goals of developmental psychologists who are interested in observing behavior of infants and children as they age, one of two research methods is frequently used. One way to collect data is to observe one group of participants over a long period of time. Perhaps you might repeat your measurements at



regular intervals. This is called a longitudinal study. It does allow us to study the effects of early factors on later behavior. It also gives us good control over such things as intelligence and personality when we draw our original samples. But there are also problems here. Any errors in selecting our participants at the start remain in the data for the entire experiment. Thus, the sample and design of a longitudinal study are no more sophisticated than psychology is at the time the sample is established. Moreover, such experiments take a long time to conduct. Psychologists age just as rapidly as anyone else. As described in the Appendix, longitudinal studies use a within-participants design. It almost seems that the only way a good longitudinal study can be conducted is for a young psychologist to have a good idea for an experiment early in his or her career!

Another way to gather data is to conduct a cross-sectional study. This involves a one-time-only period during which two or more groups of different age are observed. In such a study we would usually use the same measures for each group. Obviously, such studies have some advantages. The time to conduct the study is usually quite short. And the findings are likely to be more immediately useful. As described in the Appendix, longitudinal studies use a between-participants design. We wouldn't conduct such a study if we didn't have a need to answer questions that are important right now.

Yet, there are also difficulties. Any time you try to compare groups of people who differ in age, you have a very complex problem. Trying to choose participants for each group who are similar is not easy. The problem, as we discussed elsewhere, is controlling all the confounding variables.

There's another problem. One of the phenomena discussed in our treatment of long-term memory is flashbulb memories. Each group of people who are generally the same age are called a cohort. Their life experiences are more similar to one another's than they are to those of a different age. One major difference is the flashbulb memories they retain -- events so startling that we remember not only the event but where we were, who we were with, and what we were doing when we first learned of an event. For people in their late 60's or early 70's, their usual flashbulb memory is the assassination of President John F. Kennedy in November 1963. For those in their 20's, a frequently

cited flashbulb memory is the World Trade Center disaster. Each age has a different cumulative experience as they mature; likely, this influences their beliefs, their behaviors. The effects of differing cohort experiences confounds comparisons across differing age participants.

In addition, we may not be able to study the effects of early experience on later behavior. Why? Because record-keeping was not always good in years gone by; therefore the only record of what happened to our parents and -- especially -- our grandparents is often their own memory. Memory is helpful, except for some problems we discuss in the Remembering chapter. However, you wouldn't let a player for the Washington Redskins serve as referee in an NFL contest between the Redskins and the Dallas Cowboys, would you? For the same reasons, we are each poor observers of the events influencing our own lives. We are not impartial. Using longitudinal and cross-sectional research techniques, developmental psychologists can begin to identify what influences our development.

Think About It

The question: If you and your parents and their parents all graduate(d) from high school at the top of their (your) class, who will know the most: You? Your parents? Your grandparents?

The answer: You should now know enough to understand that this is a very hard question to answer. It's neither a cross-sectional nor a longitudinal study: The age of the people involved is different, yes, but the quality of the schooling received by each of you is also different. What if we were able to give a test of knowledge to you at graduation, as well as to your parents and grandparents when they had graduated? We'd still have the problem of the differing quality of schooling. Who's smarter? In some ways, that's almost impossible to answer.

What is Development?

The methods of developmental psychology have been applied to increase our understanding of developmental processes which influence almost everything psychologists study -- from seeing to talking, from eating to sleeping. Here -- whether studying early development in infancy and childhood, or development from adolescence through death -- we are discussing development from what is called a life-span approach. And our discussion of developmental processes at each age is limited mainly to four areas: (1) physical changes or growth, (2) motor and sensory development, or changes in performance skills, (3) development

of language, and (4) development of the self-concept, which includes an awareness of things such as emotions, intelligence, and social skills. What is development?



Development refers to the changes in behavioral and cognitive capabilities organisms experience as they live. Though this may involve either gaining or losing abilities or qualities, it emphasizes orderly, systematic change, as we'll see. Development should be

contrasted with maturation, which involves only those changes in behavior that can be directly traced to physical growth. Learning to ride a bike or to drive a car provides a good example of the difference between maturation and development. To master control of a bike or car you must be big enough physically to handle the controls and developed enough personally and socially to appreciate the responsibilities that are involved. Development refers to qualitative aspects of your behavior; maturation refers to quantitative aspects such as the state of your body and its readiness for a behavior.

There are two major groups of factors that influence human behavior: heredity and environment which registers its effects in several ways, including effects of our physical environment and our social environment both within the family and beyond the family. These hereditary and environmental factors also interact to produce specific effects in any one of us.

Now, before we look at the effects of hereditary factors, let's clarify some issues. First, the environment in which we live has a direct influence on both our behavior and our development. Any child raised by a family that is abusive, or that fails to meet the child's needs, is more likely to have psychological problems. Such a child is less likely as an adult to be as well-adjusted than is one raised in a family that is loving and responsive. Different environments cause different changes in behavior. The quality in human beings that allows such changes to take place is called malleability.

But then there's heredity to consider. There are limits to how much we can change anyone's environment and expect it to show up in his or her behavior. To be malleable does not mean that all individuals raised in the same environment will develop identical skills. Think a moment. If a fire occurred at a party, some of your friends would be too scared to move. Others would scream. Some would act to put out the fire; others would rush for the exits. And the same is true of most situations in

which we humans may find ourselves. Some of us are active, some passive; some happy, some sad; some tall, some short; some smart, some not so smart. Part of what accounts for these differences is inherited capabilities.

Unfortunately, many people think about inherited characteristics only in terms of simple things such as eye color. We all know that no amount of practice is going to turn blue eyes into brown. But many people also assume that any characteristic that is inherited -- or known to be genetically caused -- can't be changed. They assume an inherited characteristic isn't subject to the whims and changes of the environment. That's not so. It is important to realize that genes do not define your behavior absolutely. At best your genes create what some psychologists have called a "range of possible experiences." Your environment, then, determines what your actual experience will be.

Heredity



Across the entirety of developmental processes which impact our behavior, the primary hereditary factors are two kinds of inherited "information." One is general information which yields humans or dogs or giraffes as the information dictates. The other is specific information. It passes on patterns that cause

you to mature into a being who can be identified as part of your own family. Such patterns include your hair and eye color, your skin tone, the shape of your hand and head and body. But the specific information also includes more complex factors such as your general level of excitability, your intellectual potential, and even certain aspects of your personality.

Many things determine how we study the impact of heredity. There are values such as religion, morals, and love which prohibit using humans in research on the effects of heredity. In addition to these ethical issues, there is a practical one: If humans were studied, the experimenter would be outlived before his or her participants had had a chance to demonstrate all their behaviors! For these reasons, to understand hereditary

influences, scientists have turned their attention to other living things -- including plants and animals.

One of the most frequently used techniques for studying inherited characteristics is the process of selective breeding. The work of Gregor Mendel was the original in this area. Mendel worked with the garden pea, but the basic principles he developed have since been applied to both humans and animals. These same techniques have also been applied to the study of behavior.

Feature 1 presents one of the classic studies of selective breeding of animals. As you can see from this study of rats, one procedure involves selecting two animals to breed, both of whom are good examples of whatever trait is being studied. The breeding is then used to "purify" that characteristic.

Feature 1

PARDON ME, YOUR BREEDING IS SHOWING

In the late 1920's one psychologist gathered up 142 rats. In addition to reducing the local rat population, this also yielded a random sample of local rats. The psychologist had all 142 rats run through a maze from start to finish 19 times. If they reached the correct goal box, they earned a piece of cheese. For all 19 trials the number of errors each rat made was recorded. As you might suspect, the rats performed better with practice. In fact, some rats ran more than half the trials without making any wrong turns at all.

When the experiment was done, the average performance of all the rats was plotted, as you can see in Figure (a). In this random sample the total number of errors in 19 trials ranged from 9 to 214. Some of the rats making the least number of errors--called the "maze-bright" rats--were selected to mate. In addition, some of the rats that made a lot of errors learning the maze were selected for breeding. These were called--surprise--the "maze-dull" rats.



Figure a

All of the children (they're called progeny) of the maze-bright and maze-dull rats then tried to learn the same maze

in 19 trials, the errors again being recorded. The same procedure was repeated through eight generations. Each time only the brightest and the dullest of a generation were bred to produce the next generation—bright breeding with bright and dull with dull.



Figure b

Figure b shows the performance of the third generation—the grandchildren. Notice that already the performance of the progeny of the brightest rats is beginning to separate from that of the progeny of the dullest rats. And Figure c shows the performance results from the progeny of the eighth generation. By now the maze-bright rats' performance is so good that it almost doesn't even overlap with that of the maze-dull rats.

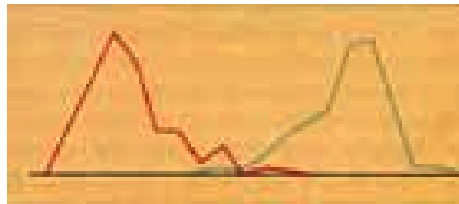


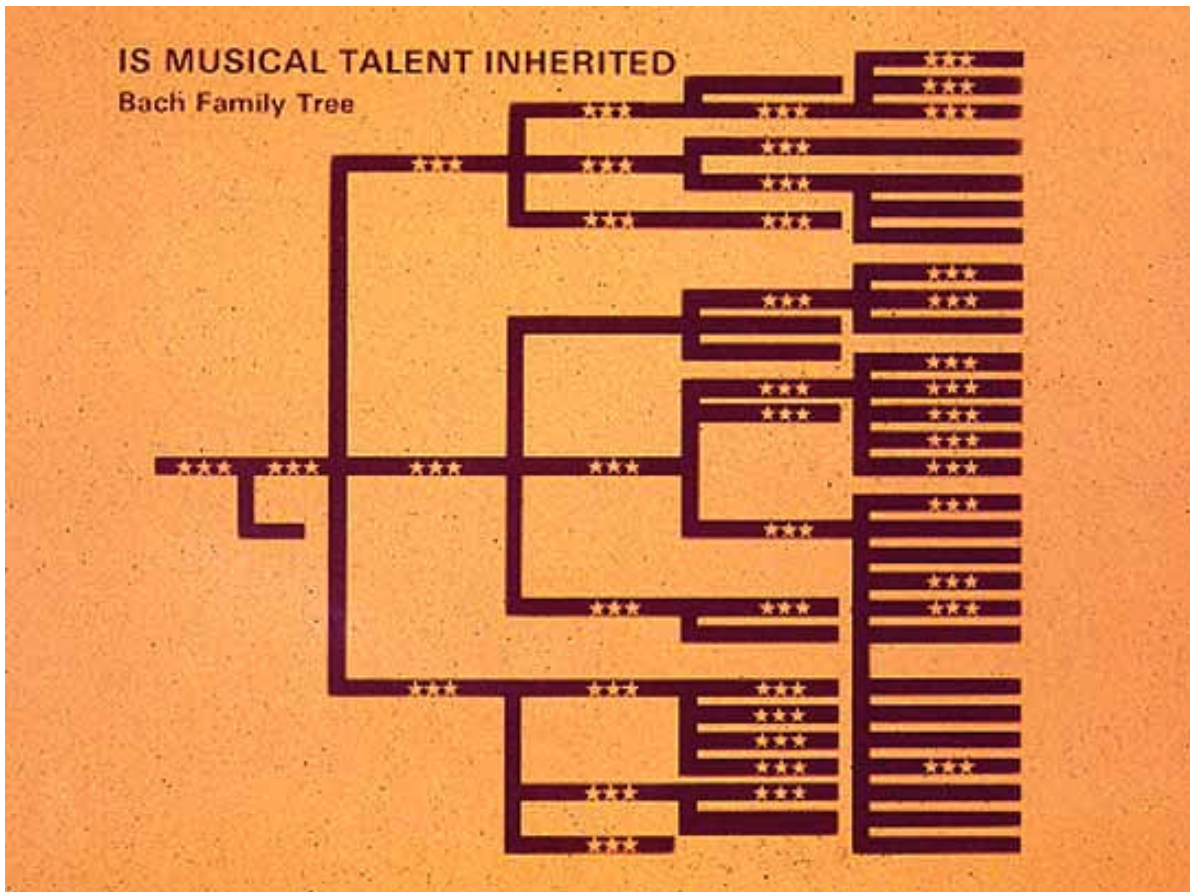
Figure c

What these rats demonstrated, of course, was that it was possible to breed for behavioral characteristics. This was among the first times this was demonstrated in the laboratory. But don't be misled. Don't assume the maze-bright rats in this experiment were bright in everything they attempted. Far from it. Another psychologist took the eighth generation rats and put them in a similar, deeper, water-filled alley where they had to swim. Here you could not distinguish their performance from the maze-dull rats in the previous experiments. So, although the experiment produced rats that were very "bright" in one kind of experiment, it did not produce a breed of Albert Einstein-like rats.

In the study of inherited factors in human behavior, two techniques are most frequently used. One is the study of twins. Here we can examine the similarities and differences in the

behavior of two humans. We know more about the genetic information than we would about any two people selected at random. Identical twins are created from a single fertilized egg -- of which we'll talk elsewhere in this chapter. Their heredity is identical. Fraternal -- non-identical -- twins are created from two separately fertilized eggs. We can compare identical and fraternal twins who have been raised together or separately -- as might happen if twins are separated shortly after birth and raised in adopted or foster homes.

Such studies have suggested that inherited factors do seem to influence intelligence, some personality characteristics, susceptibility to schizophrenia (which we discuss in the chapter on behavioral disorders), as well as shared interests and attitudes toward authority. There are, of course, a number of problems in isolating the effects of environmental factors from those of inherited factors. These problems are well-illustrated in the other technique which has been used to study the influence of heredity on human behavior -- the family tree.



Look at the family tree illustrated in this Figure. This shows seven generations of the ancestors and later relations, or

progeny, of Johann Sebastian Bach, one of the most famous classical musician/composers ever to live. From this technique of study, called genotyping, you can see, from 50 to almost 90 percent of the people related to J. S. Bach in each generation gained the main part of their livelihood through music -- playing it, writing it, or conducting it.

Yet, there's a problem. Are we to credit this love of and predominance in music to heredity or environment? If it's true that to be a classical pianist you need a finger span from the tip of your little finger to the end of thumb that will cover 13 white keys on the piano keyboard, then perhaps we should argue that heredity was the critical factor. But don't you suppose the children of J. S. Bach heard good music in their home? And don't you suppose that the Bach children -- if they showed any skill in music -- would've been encouraged, maybe even forced, into musical activities? In the absence of records, we'll never know. So separating the influence of heredity and environment isn't always easy. We have more to say about this elsewhere in this chapter. You should have detected, however, that our environment -- both our physical environment and our social environment within our family and beyond our family -- also impacts our development.

Physical Environment and Development



Clearly, our heredity impacts our development, yet just as obviously, so does our environment. In analyzing the role of the environment in influencing our development, we've got a problem. Deciding exactly what qualifies as an "environmental influence"

is a bit hard to do. In one sense, environmental influences include everything that is not inherited. Perhaps the best way to simplify this problem is to distinguish between physical and social environmental factors -- both within the family and beyond it.

Up until birth, your physical environment literally surrounds you. It surrounds you more loosely after birth, but there are still a number of important influences. These include, first, the ecological factors surrounding you, such as the quality and the temperature of the air you breathe. Under certain conditions sound can be a stressor; those who camp do not go to the woods or the shore to listen to someone else's

choice of boombox music. Residents of buildings near major highways, airports, or rail lines may experience stressful amounts of noise.



A second physical factor is the food you eat. Our diet now is generally better than in the preceding decades, yet it's far from perfect. For example, a battle has long raged about whether saccharin does/does not cause cancer. If it does, how much does it take

to make the danger of getting cancer something worth worrying about?

Food additives -- for color, for flavor -- may also influence the quality of our food. And, surprisingly, whether or not we cook our food and how we do it may end up subtracting from the raw food elements that would be good for us. Vitamins and some nutrients can be lost in the processes of manufacturing and cooking certain foods.



Third and finally, chemicals are a very important contributor to our physical environment. As discussed in more detail in the Chapter dealing with physiological processes, some drugs serve only to "pollute" our body with chemicals that can be dangerous in large

amounts. Each of these factors in our physical environment is an important influence in our lives.

Social Environment Within the Family

In addition to factors in our physical environment which influence our development, there is another, completely different source of environmental influence. Your social environment is made up first of family members. Later, friends and role models beyond or outside your family are added. Their relative contribution depends directly on your age and the restrictiveness of your parents. Let's look at some social factors within the family.

Within the social environment created by a traditional family, one or more of three elements may be important: your mother, your father, and your siblings (brothers and sisters), with the possibility that other relatives may also live with and influence you. Your parents play several important roles (detailed in the Chapter discussing Social Behavior in Groups). Parents usually provide financial support and supply the emotion (love) that ties a family together. They also teach cultural values: It's not nice to litter. You should respect proper authority. Be honest. Finish any job you start. Brush your teeth twice a day. You know what these "cultural values" are!

But your parents also play a major role in shaping your personality. They reward you for getting up on time. They instill good (or bad) manners in you. They influence your views of members of other races, communities, and nations. In short, they shaped a lot of the values you held at least up through high school. (We discuss in the Chapter covering from puberty through old age how some of this early training changes once you leave your parents' home.) Finally, your parents also decide (and enforce?) who does what jobs and when -- very important decisions if a family is to operate effectively.

Now, while these are things your parents share, there are also some marked differences in the roles played by your mother and by your father. Some contributions are almost always made only by one or the other.



There are also the social contributions made by your siblings. We'll discuss their importance in more detail in the Chapter discussing social behavior in groups, but notice your siblings do have an impact on at least your childhood and early adulthood.

The social environment within your family is most important until you enter elementary school. From that time on, an increasing proportion of the social factors influencing your development come from outside or beyond the family group.

Social Environment Beyond the Family



Of the major sources of social environmental influences beyond the home which impact our development, arguably the most powerful is television. One source suggests that the average high school graduate of the 80's had spent more time in front of a television set

than in a classroom since entering first grade. The influence of television is probably even stronger today. And what are the effects of that much television viewing? The catharsis theory suggests that watching aggressive acts on television reduces the likelihood a person will act aggressively. By contrast, the social learning theory suggests that if children learn by watching, then seeing acts of aggression on television should increase a child's aggression rather than lessen it.

A report summarizing a decade of research on the effects of television was released by the National Institute of Mental Health in 1982. It concluded that violence on television does lead to aggressive behavior by children. Researchers are only beginning to study whether television also influences children's thought and emotional processes. Can children's social beliefs, behavior, and relationships -- even their health -- be influenced by television? Pressure to smoke is greatest in junior high school. Can television be used to blunt those pressures? All sorts of possibilities abound.



A second social factor beyond the family, obviously, is school. Schools are intended mainly to achieve two purposes. One is to teach the intellectual skills that citizens will need to succeed in society. These are the old "readin', writin', and 'rithmetic."

They are the means to communicate the content of society's progress so far.

There is less agreement about the other purpose. Many people feel that school should improve a student's self-esteem. It should provide opportunities for and guidance in developing social skills. It should, in short, help students learn about how to live and enjoy life, how to play, how to think logically, and how to enjoy esthetic beauty, whether that be art or music.

The relative emphasis to be placed on "the three R's" and social skills tends to be controversial.



A third major source of influence beyond the family affecting the behavior of children and adolescents is the peer group. That is the friends and schoolmates of generally the same age. It may be the child next door, a boy- or girl-friend, or just members of one's classes in

school. The influence of the peer group doesn't really develop until school age, but it becomes extremely powerful during high school years. Many parents worry about their children's choice of friends. What parents (and you, for that matter) may not know is that most children and youths tend to choose friends of whom their parents would approve anyway.

Another social factor, which was more directly controlled by your parents when you were in high school, is the degree to which your peer group will have influence over you. This tends to be in inverse proportion to the amount of influence your parents exercise. If your social, emotional, and other needs are met by your parents, you will have less need in high school to turn to your peers for support, for experience, for anything. Beginning with college, parents are essentially replaced as a major source of influence by the peer groups.

Recent research has revealed a final point. Some psychologists have noticed that peer groups serve as "levelers." Such groups provide a low-threat means for you to find out whether the training you've received at home works correctly "out in the real world." If your parents are too conservative, your friends are likely to seem wild to your parents. If your family life is quite liberal, your friends may perceive you as a "wild" person.

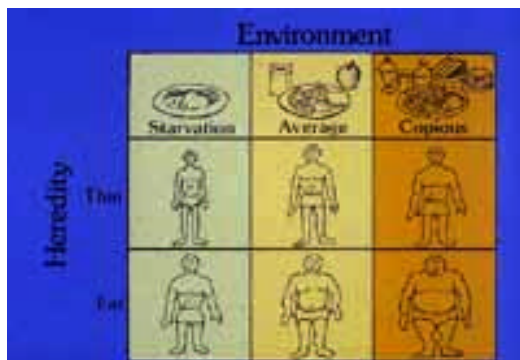
So the combination of friends (and foes), family, school, and television educates you in the ways of the world. Some psychologists talk of hereditary and environmental influences as separate, but equal, but are they? Others argue in favor of an interaction between heredity and environment.

The Interaction of Heredity and Environment

As discussed in the Chapter on the Nature and Nurture of Psychology, the old nature-nurture argument is often posed as an

either-or kind of debate, but it isn't. Rather, it should be concerned with "how much of each?" In the behaviors of interest to psychologists, your inheritance (nature; your genetic structure) sets a range of possible responses that you might achieve. The environment (nurture) can provide a range of possible experiences, but yours will be a particular environment. What occurs in each of us is a reaction uniquely determined by our heredity to the particular environment in which we find ourselves.

Some feel that we tend to consider ourselves passive lumps of clay, moldable in any way by the environment to which we are exposed. Actually, we play a vital role in choosing our own environments. We often select environments that we like and reject those that we dislike.



Look at the Figure to see what can happen if we combine nature and nurture in one specific example. Suppose your genes had given you a large frame -- big bones and a stocky build. Think about the different effects that environments offering (1) too little, (2) adequate, or (3)

(3) too much food would have on your body. Now compare the impact of these same food conditions if the original genetic message had been to create a small frame for you -- small bones and a slight build. What is the difference between a genetically stocky frame raised in a food-poor environment and a genetically slight frame raised in a food-rich environment? The differences tend to disappear, don't they? Both heredity and environment influence biological and psychological factors.

Moreover, heredity and environment -- both within and beyond the family -- interact in another complex way to determine how we develop. For the sake of argument, let's assert that the introversion you experience [a tendency to seek quiet environments, to prefer small (or no!) groups] is hereditary. If so, you would be genetically guided toward selecting environments in which an introvert would be comfortable. As an adult, you'd likely be an introvert. But, at what point does your repeated exposure to the introvert's favorite environment itself -- as an environmental factor! -- begin to influence your choice of environments? Certainly, you gain more experience with introvert-comfortable environments, less with other environments. At what point does your selection of environments become environmentally governed? Separating the

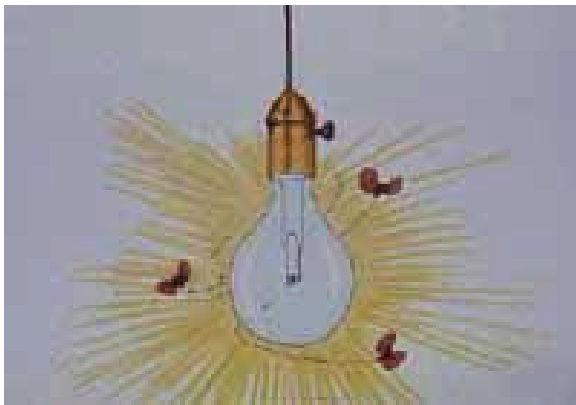
relative contributions of heredity and environment as well as the interaction between them can become very complex.

Heredity has demonstrable effects on our behavior; as does our environment. Most interestingly, the interaction of heredity with a specific environment leads to very complex effects.

Development and Forms of Behavior

The study of development, including the relative influences on development of heredity and environment to our behavior, has involved a wide variety of research techniques. Some of the facts about human development were first suggested from the study of animals and the forms of behavior which they exhibit.

In studying the range of animal behaviors -- from the simplest one-celled amoebae to the most complex multi-celled primates and humans -- one thing becomes obvious. As you progress from simple to sophisticated organisms in the animal world, you also move from automatic to rational, controlled patterns of behavior. Let's look at five such forms of behavior starting with the simplest.



A taxis (pronounced TACK-sis) involves the response or orientation of a whole animal either toward or away from some physical stimulus. We humans have a negative geotaxis. That means that we orient ourselves away from the pull of gravity. In short, we stand up.



A reflex is an unlearned response to a stimulus. However, unlike the taxis response, which involves the whole organism, a reflex usually does not. If you've ever visited a doctor's office, more than likely your doctor has tested your knee-jerk reflex by tapping your knee gently with a rubber mallet. Your foot responds involuntarily by kicking upward. This is the knee-jerk reflex.



A third form of behavior is the instinct. An instinct is a complex pattern of response that is unlearned and present in all normal members of a species. Unlike reflexes, which are fairly simple, instinctive responses may last for some time after the stimulus that initiates them.

The last two forms of response will be mentioned here in our discussion of early development, from creation to adolescence, but we spend whole chapters discussing them elsewhere. One is learning, which we'll define for now simply as instances where experience modifies or alters behavior. If you start salivating every time you smell lasagna, that's an example of learning. The other and most complex form of behavior is reasoning. This involves the use of abstract symbols, such as a written language or a system of numbers. Using such a system to solve problems, communicate, or educate illustrates the use of reasoning. An example? How many words can be made from the letters in TEXAS? Answering that question involves reasoning.



As you move up the hierarchy of animals, you find more and more reliance on higher response forms and less and less reliance on simple, automatic responses. For the simplest animals, such as protozoa, all responses are automatic. At the other end of the scale,

our human behavior involves only a very few taxic responses. We have a few reflexes and instincts, but we rely strongly on learning and reasoning for most of our behavior.

Think about it

The question: The summer camp counselor we quoted at the start of the chapter was surprised to find that the spider he interrupted started web-building from the very beginning again. Are you?

The answer: You shouldn't be. Weaving a spider web is an instinctive response. The spiral weaving response is probably set off by the existence of the main supports of the web. When the web lacks those main supports, the spider starts again by first spinning the main supports for his web.



Development and the forms of behavior which evolve have been studied from a variety of perspectives. One unusual view involves work of biologists interested in identifying the biological mechanisms underlying human and, especially, animal behavior -

the work of ethologists. The lessons of ethology also apply to human behavior.

Ethology

Among the most skillful studies of development of animals' behavior has been the work of the ethologists which has evolved out of the work of biologists. Ethologists are zoologists who apply the principles of naturalistic observation to the study of animals' behavior in their natural environment. Work of this kind was so good, so new, and so challenging that three of the first ethologists earned the Nobel Prize in 1973 for their contributions -- work which has implications for human behavior.

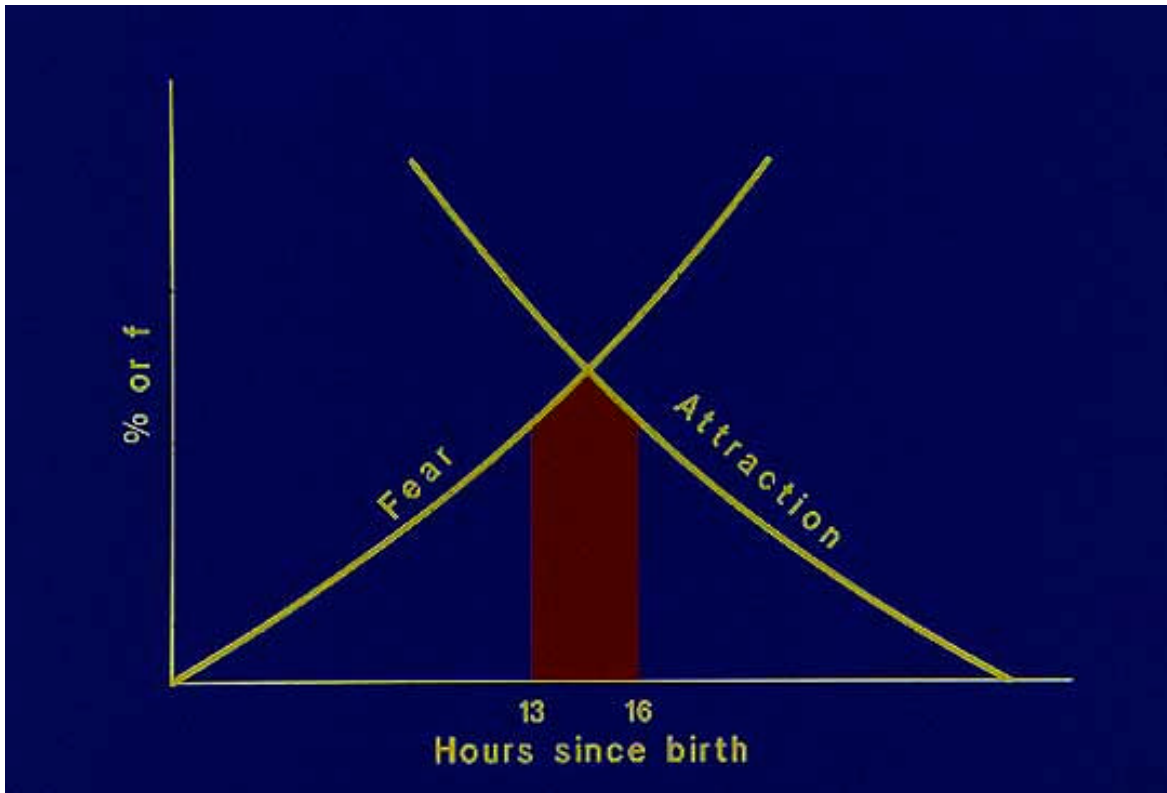


The photograph shows a number of greylag geese following ethologist Konrad Lorenz. In fact, they have imprinted on him, a process that involves an interesting combination of learning and maturation. There are three necessary elements in imprinting. These elements

are timing, the presence of an object to be imprinted on, and young organisms at the particular age of imprinting. It happens in many animals, but especially in birds.

When birds hatch, the first living, moving object they see is usually their mother. They imprint on her and will follow her anywhere. But what if birds are raised in an incubator, and

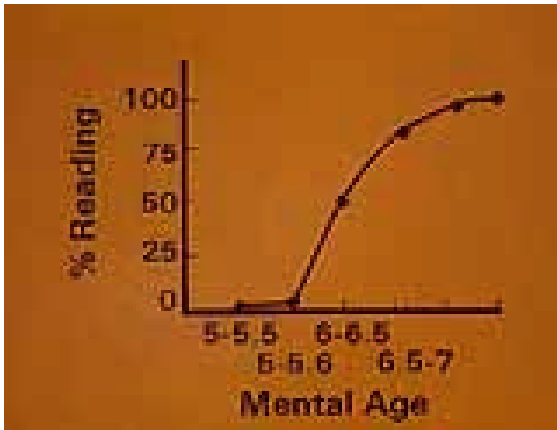
the first moving object they see is a decoy? If this happens, the birds will imprint on the decoy. In fact, the farther those birds have to follow the decoy, the stronger will be the imprinting that results. In Lorenz' case, he had been the first thing the goslings had seen.



It has been suggested that imprinting takes place during a time interval limited by (1) an increasing fear of strange objects, and (2) a decreasing inclination to approach anything that moves or attracts attention. The combined effects of these two processes yields what is called a critical period. It is a period of time during which the events that will cause imprinting must occur if it is to result. Early enthusiasm surrounding the discovery of the imprinting process lead investigators to think that once the birds were imprinted to a decoy (as the goslings were to Lorenz), the process couldn't be reversed. Not so.

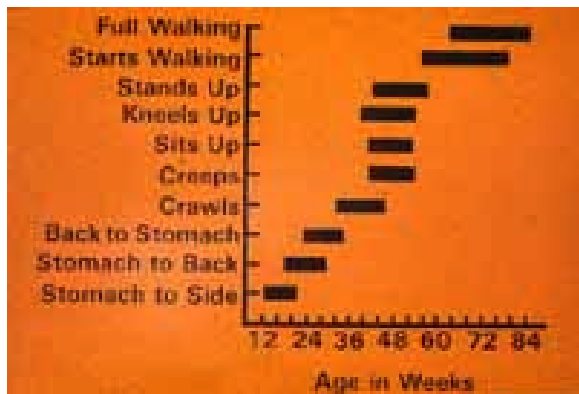
More recent work has shown that imprinting on an incorrect object is less stable than if an organism imprinted correctly. Ducks imprinted to humans -- when later exposed to their own mother for a period of time -- will stay with her rather than returning to the person on whom they had originally been imprinted. Surprisingly, this work also has implications for humans' development.

How About Humans?



The work of the ethologists has focused primarily on the development of specific forms of animal behavior. Are there critical periods in humans? The evidence so far suggests that we do have critical periods -- perhaps quite a number of them -- during which we need certain kinds of experiences. We need exposure to other

humans in order to learn to speak and to learn various social skills during the early years of infancy and most of childhood. And we need the handling, attention, and care of a mother or father in the earliest years of infancy. People denied these opportunities seem to suffer from slow learning of the missing skills when the opportunity finally presents itself -- if they are able to learn the needed skills at all. Clearly, delaying some experiences beyond these ill-defined "critical periods" can have damaging effects.



A final concept, important to both humans and animals, is that of maturational readiness. This identifies the first time an organism is physically ready and able to respond correctly in a particular situation. With humans, for instance, there has long been an argument as to the best time

at which to start training a youngster to read. Certainly, many children started at the age of three or four can do very well if given constant attention. Yet others not trained at all until the age of six or so seem to catch up quite quickly. Purely as a matter of efficiency, is it necessary to start children as soon as they can hold a book up? Apparently not. It seems that the point of maturational readiness to learn to read is reached when a child -- no matter how old he or she actually is -- can do what the average five to five-and-one-half-year-old can do.

The illustration describes in some detail how principles of maturation operate in all humans in definite, predictable sequences. You might also refer to where we show the various stages taking place as children learn to walk as another example of maturational readiness.

Human Development

Based on the development of techniques for study of developmental and maturational changes, another question becomes of interest. What developments take place within the individual human from the time he or she is conceived through infancy and childhood to adolescence? In this Chapter on Early Development and the Chapter on Development: Adolescence to Death we talk about many events in normal development, starting with procreation, continuing through when the first word is spoken, when an infant can stand and walk, and so forth. The figures we cite and the graphs and figures show average figures, or norms.



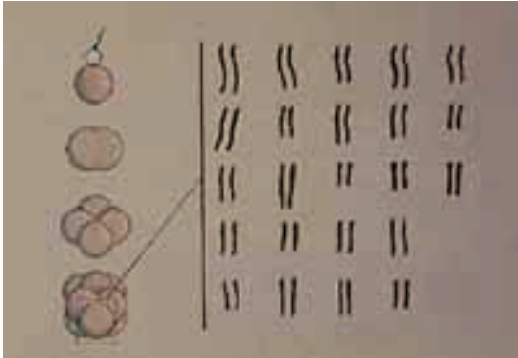
Knowing a norm is like knowing the average shoe size of an army: It's descriptive, but useless in equipping personnel. Keep in mind that there are wide variations among humans in the rate at which they mature and develop. The process starts with human procreation and -- still within mother's

womb -- includes prenatal life. Our discussion includes changes in infancy, including body changes, motor skills, and how we interact with our world as infants. We also look at changes in language development in infancy as well as in childhood, and we discuss our evolving self-concept both in infancy and childhood. We summarize the major changes in childhood skills and body and look at how a knowledge of psychology can help with parenting.

Genetics, Dominance and Recession

As you already know from biology courses, the process of procreation in humans begins when the sperm from a male unites with the egg of a female to start the development of a new human. The chromosomes within the fertilized human egg (or zygote) are composed of bead-like strands called genes. Genes

contain the genetic code. This code is the order in which molecules transmit genetic information, or all the characteristics that are passed on through the generations. It has been estimated that there may be 10,000 to 50,000 genes in each fertilized egg!



The genetic code itself is embodied within structures of DNA, or deoxyribonucleic acid. The DNA is the master key determining the genetic portion of the physique and the potential behavior of every soon-to-be-born infant. Each of us was created by a mixing of many genetic

messages -- about hair, skin, and eye color, about physique and abilities, about everything -- at the moment of procreation. However, we do not result from a mixing of our parents' characteristics as when you mix paint. Let's say the genetic codes of a man and a woman have been combined. What happens if one message says "blue eyes" and the other says "brown eyes"? A dominant gene, such as the gene for brown eyes, exerts its full effect over the effect of a recessive gene, such as the gene for blue eyes. Thus, any mixed genetic message will be expressed in the individual child in accordance with the dominant gene. The effect of a recessive gene will be expressed only if paired with another recessive gene. Our bodies or abilities may show the effects of a dominant gene even while we carry recessive traits and may transmit them to our children.

The theory suggests that we, the carriers, do not influence the genes we carry. We simply pass them on to our children. The Bach children whom we discussed earlier may well have become interested in piano through their parents' interest. But they could not know how to play a Bach concerto through a genetic message. They had to learn. And thus the human embryo is launched on its prenatal life.

Think about it

The question: Well, what's your verdict? Can brown-eyed parents have blue-eyed children?

The answer: Yes. You can construct a table as follows, where B = brown (the dominant eye color) and b = blue (the recessive eye color). In short, if Marcia's parents are both of the Bb type themselves (with brown eyes but carrying recessive blue genes), the chances are that 25 percent of their

children would have blue eyes (bb). As for the others, 25 percent would have brown eyes (BB), and 50 percent would have brown but be carrying recessive blue genes (Bb).

	Father			
	B		b	
Mother	B	BB	Bb	children
	b	Bb	bb	

Prenatal Life



Though somewhat determined by genetics, the maturation of the human zygote, later embryo, is generally most susceptible to the effects of a poor environment during the first three months (called a trimester) of growth following procreation. As organs and life systems

mature, there may be times when some pollutants have a higher than normal likelihood of causing certain abnormalities. Diseases, drugs, and various medical treatments, such as x-rays, may have bad effects. Poor eating habits of a mother-to-be take their worst toll during this time. Unfortunately, a woman may not be aware that she is pregnant during this critical first trimester.



During the last trimester the fetus is already beginning to react to events outside its mother. One researcher placed a small block of wood over the abdomen of mothers in the latter part of the eighth month. When these

researchers hit the board lightly with something that emitted a loud noise, about 90 percent of the fetuses began squirming excitedly and kicking. (See Table 1 for a definition of this and other terms we'll be using.)

Table 1*Ages and stages for children*

AGE	NAME	STAGE
0-2 weeks*	Zygote	Germinal phase
2-8 weeks*	Embryo	Embryonic phase
2-9 months*	Fetus	Fetal period
0-2 years	Infant	Infancy
2-7 years	Child	Early childhood
7-12 years	Child	Late childhood
12-20	Teenager	Adolescence

*Age from conception.

Even before birth fetuses show vast individual differences. Ask any woman who has had two or more children -- babies differ tremendously. Some fetuses may be active 75 percent of the time, others only 5 percent. Some pregnant women have even reported they preferred not to go to symphony concerts -- their babies responded to the music and applause with violent squirming! So the evidence is more and more clear-cut that fetuses can and do respond to environmental stimulation even before birth.

Another thought may have occurred to you. Does the mental state of the mother during pregnancy affect the baby before and after it is born? Obviously when any of us get upset, our body chemistry changes. If we are afraid, our adrenal glands pump actively, while our digestive processes stop. And if we're sad or angry? Happy or delirious? The answers here are less easy to provide. One study has been done of the babies delivered to mothers who were suddenly faced with an extreme fear or grief (as in the loss of the father) or anxiety during their last trimester of pregnancy. Generally the unborn fetuses of such mothers tended to show marked increases in their activity -- as much as a tenfold increase sometimes -- at the time of the shock. After birth these infants were mentally and physically all right, but they tended to be unusually irritable and very active. Some even had feeding problems.

And how about drugs? Women who smoke a lot tend to give birth to smaller and lighter infants. Infants born to mothers addicted to narcotics or alcohol tend to show the same severe withdrawal symptoms their mothers would if they stopped taking the narcotic. On the other hand, there are benefits to this

blood-linked communication from mother to fetus. Mothers' immunities to diseases such as mumps, measles, whooping cough, and scarlet fever are passed on to the newborn child.

During the birthing process itself, only one kind of injury is likely to occur. This is brain damage caused by the use of forceps (instruments used to aid delivery) or a shortage of oxygen as the baby shifts from the mother to the environment outside. Such difficulties, however, rarely occur.

An interesting theory has gained ground in the past several decades about birth being a major psychological trauma. It's an appealing idea. Leaving a warm environment that was established and designed to meet the infant's every need would seem to be a foolish thing to do by adult standards. But remember the dangers of anthropomorphism -- attributing thoughts and motives, and complex ones at that, where none may exist. Suffice to say, there is no evidence currently available that the birthing process itself is a traumatic event. It has not been shown that birth serves as the source of serious personality problems that may develop later in life.

At this point our maturing human is ready to enter infancy, the final step into childhood.

Changes in Infancy

Infancy -- roughly from birth to age two -- involves massive body changes, major improvements in motor skills including handedness and how we sense the world. Language development leads to significant improvement in self expression which ultimately leads to evolving changes in an infant's self-concept. Changes in an infant's body size that occur between birth and age two are extensive. Growth is rapid during the first year of human life. By the end of the first year, an infant triples his or her birth weight and stretches out from a starting length of 48-53 cm (19-21 inches) to a height of 63-74 cm. (25-29 inches).

There are a number of problems psychologists face when studying infant development. For one thing, early physical factors such as the size, agility, and sensing factors, as well as early intellectual abilities, are of no use in predicting a person's childhood and adult levels of such factors. A baby's length and weight at birth, for example, don't allow us to predict his or her adult height or weight. Also, there is the difficulty of knowing how to pose a research "question" so an infant will pay attention long enough to give us an interpretable answer! By the time a child is two, however, we can begin to make a few predictions with ever-greater accuracy.

Consider growth rate, for example, which slows down a bit during the second year. Even so, by his or her second birthday a child may well reach a quarter of the ideal (note, we did not say actual) adult weight. And the average two-year-old will be almost half as tall as he or she will be as an adult. Major changes also occur in an infant's motor skills.

Motor Skills in Infancy

One of the most intriguing things about a newborn infant is that despite the significant body changes which occur, a wide range of responses have already been "pre-wired." These response patterns -- some of them quite complex -- show up as reflexes.

A motor skill that is always a worry to parents is the development of handedness -- shall he or she be right- or left-handed? World-wide, only about five percent of humans are left-handed, but a clear preference doesn't really develop until the latter part of the infant's first year. Even well into the second year an infant will still experiment a great deal -- now eating with the right hand, now with the left, and sometimes with both.

Exactly why we develop a preference for one hand over the other is not clear. It may result from which side of our brain is dominant, called cerebral dominance, which we discuss in the Chapter on Physiological Processes. But it's clear that society as a whole is set up for right-handers. Everything from school desks to scissors, from hand-shaking to vegetable peelers, is designed for right-handers. Is this a cause of right-handedness, or does it result because of right-handedness? It was the fashion in the past to encourage infants to become right-handed at all costs. The best procedure now is thought to be to let handedness develop on its own. It saves worry and wear and tear on parents, teachers and left-handed children as well!

Think about it

The question: Remember the four-week-old baby girl who suspended herself in mid-air by simply hanging on to two extended adult fingers? Can this be done?

The answer: Yes. It's called the grasping reflex. It's present in only about 40 percent of all infants, and it disappears completely by the end of the third month.

Sensing the World in Infancy



When infants arrive in this world they already have some rather well-developed sensory skills for detecting parts of their environment. Yet, we know that an infant's reactions to the world about him or her are directly related to whether the infant is sleepy or alert, quiet or crying. The best time for

studying infants is when they are alert, but quiet -- which makes the task a bit difficult with newborns since they sleep most of the time. It has been learned that infants are less alert when they are flat on their backs. In that position they tend to fall asleep. It's interesting that our modern chairs for holding infants while they're being fed tend to position the infants on an incline. Perhaps this same finding regarding the influence of the incline is why infants stop crying when they are picked up and put over their father's or mother's shoulder. The smells, sounds, and other things in the world around them now catch their attention.

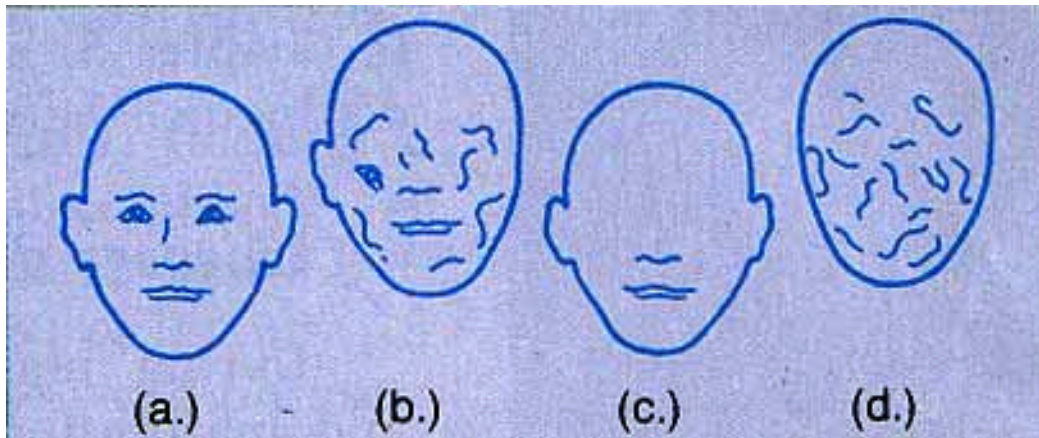
Yet, many other things also influence an infant. Too hot, and the infant will fall asleep; too cold, and it will cry. Tightly wrapped, infants tend to go to sleep; left naked, they tend to cry. Too bright, and they shut their eyes; too dim, and they'll go to sleep. Too loud, and they cry; yet with just a calm background noise (remember the use of music boxes?), they fall asleep. So finding out what an infant can do when attentive is no easy task!

In spite of this, accompanying developing motor skills, there is significant improvement in an infant's skill in sensing the world. Psychologists have learned that shortly after birth an infant is already more likely to look at a human face than at a random collection of the same number of features, as discussed in Feature 3.2 We know from this that infants can see shortly after birth. Yet, other work has shown that the focal point of an infant's vision is only about nine inches away from his or her face. Interestingly, that's about the distance many women hold their infants from their own face when nursing them.

Feature 2**WHAT DO INFANTS SEE?**

When we make statements that an infant can do this or can't do that, a problem must have occurred to you. How can we find out what an infant too young to tell us can actually do and see and hear? When infants start crawling, can they detect when they've reached the edge of a staircase? In fact, let's take a specific problem that was important to each of us: Can infants recognize a human face? Can they see at all?

We do know that infants can detect and respond to differences in brightness and motion when they are not even one day old. They prefer, in their first weeks, to look at the edges of stimuli—as if they are learning first the shapes of stimuli. But how about a face? Can an infant detect the difference between a face and an equally complex figure that is just a number of scrambled parts?



To answer this question, the four forms in the illustration were shown to a number of four-month-old infants. Several findings are immediately apparent when we examine what proportion of the total viewing time was spent looking at each object.

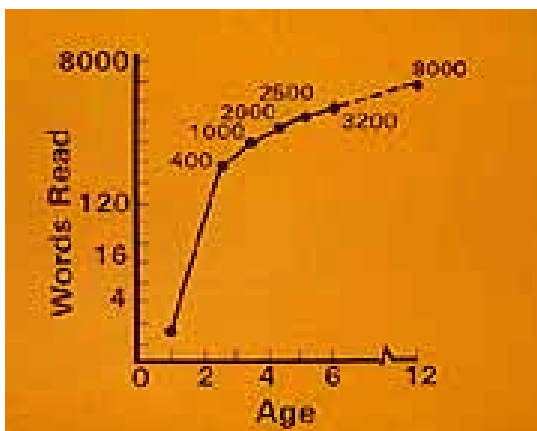
First, the most normal human face drew the most attention. Second, the form with the fewest details drew the least attention. Third, when choosing between two forms of equal complexity (Faces b and d), infants gazed longer at Face b. This suggests that the meaning of the form—the face in this instance—may be more important in attracting and holding an infant's attention than the complexity. All this was learned

just by showing some infants some forms and watching what they watched!

How about hearing? Elsewhere in this chapter we discuss fetuses who become very active if a loud noise is produced outside their mother's womb. Shortly after birth an infant can be trained to turn his or her head toward a bell if food is given when the infant does so. When held upright between parents who are both speaking to him or her, the infant will turn more often toward the mother, perhaps because the mother is already the more familiar person.

If a change in its environment is detected by an alert infant, several things tend to happen. Its level of activity increases, and its heart rate and pattern of breathing change. We can use this to find out what infants can detect. For example, we now know that infants can smell even within two days after birth. First we get them used to smells ranging from acetic acid (a much less concentrated version of which exists in citrus fruits) to anise (which is like licorice). Then, if one of those smells is changed and that change is detected, what do we find? Right. The activity level, heart rate, and breathing all change. Taste, as we'll see in the Chapter discussing Sensation and Perception, is not as sensitive as smell, yet infants can even distinguish between their mother's milk and a cow's milk! Paralleling these improvements in motor skills and sensory skills, the infant's language development undergoes substantial change in the first two years -- from speechlessness to limited loquaciousness.

Language Development in Infancy



During infancy it seems that factors of physiological growth and maturation play a large role in the language skills that develop. This is suggested by several things: First, the initial steps through the first couple of years of language development are remarkably similar worldwide: The same sounds appear first, everywhere. There is

the same sequence of increasing linguistic complexity and the same order of use and purpose of word classes. Second, infants have a knack for language. It would be an incredible feat to learn enough to be communicating as effectively as two-year-olds do in only two years. By that age a child has usually achieved a vocabulary of at least 300-400 words, and some psycholinguists argue the size is closer to 1,800-2,000 words! The first count of the number of words known and used by children was done more than half a century ago -- in 1926. At that time six-year-olds were estimated to know about 2,500 words. The widespread use of television and radio in modern society makes it likely that this figure is a serious underestimate for youth today. One psycholinguist has estimated a child learns ten new words a day from 18 months to 5 years of age. That would mean a 5-year-old could easily have a vocabulary of 13,000-15,000 words!

However, not all psychologists share the same opinion about how language develops. It is an area rich with arguments these days because views are changing rapidly. At birth you had only two choices: You could cry or be quiet. Yet by the time you were four weeks old you were already beginning to "say" different things. When you were uncomfortable, you got tense. As a result your vocal cords were more constricted and narrow. The nature of your crying changed. When you were happy, your vocal cords were more relaxed and you emitted a more open, back-of-the-mouth sound. It may be just an accident of muscle control, but parents can read these cues. Even as a four-week-old infant you were beginning to "speak."

At three months you reached the babbling stage. It seems to be enjoyable since infants all over the world do it. We emit random sounds, and we do a lot of it between three and six months of age. In the last half of the first year (6 to 12 months) two things begin to happen. First, infants begin to show repetitive syllabification, which means they say the same syllables over and over again. It's in this stage that most proud parents proclaim that they hear their infant's first "word." But who's to say when repeating ma-ma-ma-ma-ma-ma or pa-pa-papa-pa-pa changes to "ma-ma" or "pa-pa"? Nevertheless it does occur somewhere around the start of the second year, and who's to argue with proud parents?

The other process occurring in the last half of the first year is imitation. Infants are natural mimics. Listen to a six- to twelve-month-old infant, and you'll hear it mimicking many different sounds in its world -- some verbal, some not. But during this period the sounds being emitted are getting more and more sophisticated. "Foreign" sounds -- meaning those not used to vocalize the language the infant is about to learn -- begin to disappear. A one year-old will react to verbal

stimuli, and he or she will react very differently to angry and loving voices.

During the next six months (12 to 18 months) there is a steady increase in the number and variety and complexity of sounds being emitted. One-word utterances occur more and more often. They're mostly nouns. In the last part of infancy (18 to 24 months) single-word utterances become two-word phrases. At this stage two processes can be heard. One is the development of telegraphic speech. "Mommy milk!" may mean anything from "Mother, I would like to drink some milk." to "Mother, your elbow just knocked a one-gallon container of low-fat, homogenized and very expensive milk onto the floor." In short, the important words are there, but none of the connectors.

The other process that is heard is over-generalization. Infants try to apply simple rules in complex situations. They may learn that -ed means past tense, but then they apply that rule to too many verbs: "Daddy goed," "Mommy eated," and so forth. It's a mistake, but it's a good mistake, for it shows the infant is thinking about language. He or she is beginning to try to develop and apply the rules that will govern the use of this new-found skill called talking. The increasing complexity of language development aids the infant's developing self-concept.

The Self-concept in Infancy

One of the most fascinating things to watch as it develops during infancy is the changing, shifting view of self. Self is a very hard concept to define -- even more so for an infant. One way is to define self as anything you can touch that will result in two experiences of touch. (Touch your arm with your finger, for example. Your arm will feel the pressure of your finger; your finger will feel the warmth of your arm.) Feature 3 describes one major source that helps an infant develop a self-concept.

Feature3

TRUSTING BABIES

Crying is a very selfish thing that infants do. Almost everything else is socially oriented somehow: babbling, staring at you, smiling at you—even imitating you. But crying is very self-centered. Yet, as with so many things an infant does, the results produced by crying also teach the infant something about his or her world.

The way a parent responds to crying influences the attachment that forms between parents and their child. Attachment is the bond of affection that exists between an infant and other individuals—most often the mother and father. One psychologist studied the patterns of behavior that existed between 26 mothers and their children. We're going to look only at the most extreme cases in that study.

For example, suppose you were a parent in the following situation; what would you do? Your child is crying—apparently for food—but you've just fed it an hour ago. Would you yield to its needs and feed it again? Or would you consider your own needs and feed it on a schedule? What kind of an attachment would result when either the infant's needs dominate or the mother's needs dominate? We will find some rather surprising results.

First, with a year-old infant, letting the baby's needs predominate led to a better interaction between mother and child—yes, a better interaction. Subsequently, when it was put down by the mother and apparently deserted, the infant whose needs had been met as they developed instead of according to the parent's schedule, cried less.

So how are we to explain this? The major factor here seems to be the trust developed by the infant. If it was repeatedly left to cry, it learned that the world was not to be trusted, that its needs would not be met as they arose. On the other hand, infants whose cries were followed by having their needs met, were learning that the world can be trusted. They learned that mother (or father) was a trustworthy person, that that person would show up as needs arose. The result was that by responding to a child's cries during the early months of its life, these parents created a more trusting infant. The more trusting infants eventually cried less, were more tolerant of frustration, and offered a richer variety of communications.

But what are the tasks of the infant here? Table 2 lists the components of self-hood that develop during infancy. Perhaps the second task there best shows the difficulty in defining self. For the first several months of its life an infant

doesn't distinguish between itself and the environment of which it is a part. There is no boundary between itself and the world. Understanding that boundary is but one of the tasks in developing the sense of self.

Table 2

An infant's tasks in self-concept development

AGE	TASK
Infancy (0-24 months)	1) Identify self as able to cause events. 2) Awareness of boundaries and shape of body. 3) Awareness of viscera; events (such as a stomach ache). 4) Recognition of self (as in a mirror). 5) Recognition of self as a constant in a world offering 6) Naming of self. 7) Possessiveness.

*Adapted from Newman and Newman, 1978.

All this while, from birth to two, the infant is testing and probing its environment. One theorist (Erikson, whose work is discussed in more detail elsewhere in this Chapter and that dealing with Development: From Puberty to Old Age) has suggested one major task at this age is to form a view of the world -- of either basic trust or mistrust. Another is to begin to develop a sense of self-control. Once these tasks have been mastered, the infant is ready to enter childhood.



**Childhood Changes:
Skills and Body**

Upon concluding the major experiences of infancy, the maturing human moves into the events of childhood. What happens along the way from childhood to

adolescence? What changes take place, physically and mentally? (As you read about the evolving skills of childhood, be sure to keep in mind our caution about the limits of norms: They're helpful in identifying an average, but not in describing an individual.) These changes involve continuing increases in the complexity of motor skills of which a child is capable, and substantial body changes. Language development continues to

show increasing complexity and size of vocabulary, and the self-concept moves away from self-centered to reflect increasing awareness of others.

What skills can you expect young children to perform? In terms of motor skills, two-year-olds are able to walk with an even rhythm, and they can put on their own shoes, but they can't hop on one foot. Their drawing skill is limited to imitating vertical and horizontal lines. Three-year-olds can walk a line on the floor, but their drawings are usually just scribbles. A four year-old can hop on one foot but often only one, walk on a balance beam, and draw crude figures of humans and other objects. By five a child can hop on either foot, tie his or her shoelaces, and draw identifiable animals, houses, and so forth. From six to twelve a child is mainly involved in a general improvement of motor performance. Dancing or tumbling classes are beneficial in giving the child practice in more and more refined motor skills. The child will notice a steady increase in his or her strength, reaction time, and balance.

You have probably noticed that when you learn any new motor skill, you must at first pay a lot of attention to its perceptual, or mental, aspects. In learning to play any musical instrument, you must concentrate on where your fingers are and how what your fingers are doing is related to what you hear. Mastering any motor skill involves first integrating all the incoming information from your eyes, your hands -- in fact, all your senses. Then you practice until you have succeeded in moving control of the new skill from the conscious to the unconscious realm. For example, once a person knows how to roller skate, he or she no longer thinks about it. But compare that performance with that of a five-year-old just learning how to maintain balance, see where to go, lean, turn, and brake all at the same time! The USING PSYCHOLOGY section illustrates how the cumulative contributions of changing body size and increasing motor skills impact that most basic of childhood activities -- play.

The basic senses work quite well in the two-year-old. What continues to develop, however, is the more complex uses to which sensory information is put. For instance, one aspect of this development is cross-modal transfer. Suppose we showed you the objects drawn in the Figure. We then put them in a bag and asked you to pick out, without looking, the red object. If you came up with the right object, you would be performing a cross-modal transfer. This means that you'd have taken incoming visual stimuli and translated them, interpreting the same object in terms of touch. As children grow older, these complex skills are constantly improving -- but of course at different rates for different individuals.



There are two final facts that you should note about body changes and motor abilities in children approaching puberty. First, as the quality and general availability of both food and medical services keep improving in North America, children keep maturing at

earlier and earlier ages. Second, the age of twelve (roughly) marks the point of greatest difference in the relative maturation of boys and girls. At this time girls are from 18-24 months ahead of boys in the percentage of their adult form they have achieved! One area where there is sharing is in the complexity of language development each human exhibits in late childhood.

Using Psychology: Psychology and Parenting



Even people too young or too old to be biological parents are sometimes put in the position where they must care for young children. Do you have younger brothers or sisters? Have you been a camp counselor or a "baby" sitter? If so, knowing a little about what to expect

and how to amuse children at different ages may be of help.

Since we cover in some detail most stages of development -- both physical and mental -- in this chapter, here we only concern ourselves with play. Various studies have indicated that "child's play" isn't the simple thing the phrase implies. In fact, there's a definite progression in play behavior.

Basically, children play games that get more and more complex as they get older. Knowing about that progression will help you in entertaining children for whom you must provide care. Six forms of play have been identified.

Unoccupied behavior is the first kind of child-controlled behavior we observe. An infant will simply examine his or her own body or look around the room. For you sitters, this can be the easiest "minding" job of all. An environment with interesting (familiar!) things to see, hear, or manipulate can

keep a baby happy. Remember the fascination of the human face for an infant.

Onlooker play seems to show an awakening awareness that other children exist. The child talks with other children who are playing -- may even make suggestions or ask questions -- but does not get into the action. Watching will usually be quite satisfactory for such a child.

Solitary play involves a two- to three-year old child playing with toys all by him- or herself. None of the actions the child makes are influenced at all by what other nearby children are doing. Now, combining familiar and interesting toys with isolated observing will keep a child happy -- still assuming that all bodily needs for food and so forth are met!

Parallel play involves children playing with the same toys, but not really interacting with each other. They will be playing beside, but not with, each other. This form is at its peak in two- to three-year-olds. By this age a child appreciates having a friend around, even though he or she may be doing the same thing separately.

Associative play involves the sharing of materials, and some shared interacting behaviors. Here children have similar, but not necessarily identical, goals. This form of play starts to show up in four-year-olds, and by five the younger forms of play are not seen very often. Now group projects with plenty of materials for everyone will be a hit -- all painting separate pictures, for instance.

Cooperative, organized play is the last to occur. Now there is a single activity using the same materials and a common, accepted set of rules. Children play many different roles here. The key now is to have an interesting, challenging game with rules.

There is a surprising footnote to these findings. The study that identified these styles of play in the 1930's was repeated in the early 70's. Four decades after the original study, North American youngsters were not engaging in as many socially oriented forms of play. Certainly the last two forms of play tended to occur later than they did half a century ago. Can this be caused by too much television viewing? It's an interesting question to ponder.

Language Development in Childhood

You will recall that when we left our developing two-year-old, he/she had achieved a vocabulary of at least 300-400 words at the beginning of childhood, and some would argue the vocabulary may have reached 1,800-2,000 words. The trends that

start in infancy continue into early childhood. During the third and fourth year many more word classes make their first appearance. A vocabulary that had only nouns and verbs grows rapidly to include adjectives, adverbs, prepositions, and even pronouns -- the last major class to be mastered. During the fifth and sixth year children simply gain more sophistication in their language. Some psychologists would argue that by the age of five to six a child knows all of the formal elements of his/her language. The only skills important to the use of that language which continue to develop well past the age of twelve are the size of the vocabulary and the complexity of the sentences formed.

However, one interesting skill does develop between five and twelve -- the ability to use language to talk about language. That's a skill that is uniquely human, as we discuss at some length in Chapters on Learning and Language. This improving language is accompanied by continuing alterations of the child's self-concept.

Self-Concept in Childhood

An evolving aspect of children's personality is their self-concept. Table 3 lists the many and varied events that influence a child's self-concept as he or she progresses through Years two through 12. These factors are divided into those experienced in early and late childhood. There are marked differences in the concerns for and about the self of young children as compared to those of older ones.

In terms of the theory of Erikson, there are several tasks for the child to master between these ages. The child continues to gain knowledge about self control and begins to separate him- or her-self from mother, without feelings of guilt. Other major tasks of childhood are to develop the conscience and to begin to form a sex-role identity.

As these tasks are encountered, the developing language begins to be used as an aid. You'll hear a marked increase in "what" and "why" questions as the child ingests more and more information. There is an awakening awareness of the differences between boys and girls, and this too is explored.

Table 3

*A child's tasks in self-concept development**

AGE	TASK
Early Childhood (2- 7 years)	1). Identify internal moods. 2). Awareness of self as an object analyzed by others ("Isn't he cute?" "Isn't she smart?") 3). View of self as willful, internally controlled ("let me do it!") 4). Self as part of family, friendship groups. 5). Self as a sexual person, fitting certain sex-roles. 6). Self as a moral person with goals for an ideal self. 7). Self as (non-) initiator of events.
Late Childhood (8-12 years)	1). Physical changes leading to revision of body image. 2). Development and evaluation of skills. 3). Appreciation of multiple- roles for self.

*Adapted from Newman and Newman, 1978.

So far the family has been the major learning ground, but the last major task of childhood is accomplished mainly in school. It is to develop a sense of industry -- the ability and desire to do things and do them well. Both parents and teachers encourage this skill by achieving a careful blend of challenges to keep the child thinking positively even if experiencing some failure.

So, at this point we have a fully developed child, ready -- to the extent anyone is -- for adolescence. In adolescence that child's world -- almost mastered -- turns topsy-turvy again as he/she enters puberty.

Review Questions For Developmental

OBSERVING BEHAVIOR

1. What do developmental psychologists?
2. As used by psychologists, what is meant by "lawfulness of behavior"?

GOALS AND METHODS OF DEVELOPMENTAL PSYCHOLOGY

1. What are some of the problems involved in studying development?
2. What are the experimental methods used to avoid the

problems?

WHAT INFLUENCES DEVELOPMENT?

1. How does development differ from maturation?
2. What are the major factors influencing our behavior?
Give examples of each.

THE STUDY OF DEVELOPMENT

1. What behaviors have psychologists identified by studying animals?
2. Define critical periods and maturational readiness. Do these concepts apply to animals or humans or both?

TOWARD THE STUDY OF HUMANS

1. What sequences are followed in the maturation and development of humans?
2. What purposes do genes serve?
3. To what environmental influences is a fetus sensitive?

INFANCY

1. In the normal human life span, when is the period of most rapid growth?
2. Name some important motor skills developed in infancy.
3. Trace the sequence of human speech development in infancy.
4. According to Erikson's theory, what attitudes toward the world are developed in infancy?

CHILDHOOD

1. What ages does childhood include?
2. What motor skills develop during childhood?
3. How does the use of language develop during childhood?
4. What changes in self-concept occur during childhood?

Early Development Activities

1. According to Piaget's theory, during its first eight months an infant learns that objects have "permanence." That is, objects continue to exist even when hidden from one's view. If you can find an infant who is less than eight months old, try to determine whether the child has yet mastered this concept. Place a toy in front of the child where the child can see it. Then cover the toy completely with a towel. What does the

infant do? Infants under four months of age rarely pay much attention. Infants from four to eight months will look at the towel but probably not under it. Some infants might duplicate the feat of most eight-month-olds and search under the towel. What did your test subject do?

2. To test the maturity of a child's motor skills, see if you can find a two-, a three-, a four-, and a five-year-old. Ask each child to hop up and down on one leg. What happens? Can a child who can hop on one foot hop on the other? Practice will do very little good until a certain point of maturational readiness has been reached.

3. Career Search. Volunteer to spend some time in a day-care center. Record your observations about children's behavior, being sure to record their ages, too. Which principles of maturation and development might explain what you saw? Discuss your observations with a fellow student or your instructor.

4. At a playground or day-care center listen to the talk of two- to four-year-old children. How does their grammar differ from yours? Did you hear them use telegraphic speech or commit any errors of over-generalization?

5. To gain an understanding of children's abilities and limits in thinking, interview a number of children of different ages. You might ask a classic question such as "How does the sun get from where it goes down (in the West) to where it comes up (in the East)?" In analyzing the answers, compare the underlying logic of the children of different ages.

Interested in More on Development?

BRUNER, J., COLE, M., & LLOYD, B. (1977). *The Developing Child*. Cambridge, MA: Harvard University Press. A series of four short books, each of which provides an excellent review and analysis of important findings in its subject area. Subjects include Mothering, Distress and Comfort, Play, and The Psychology of Childbirth.

FEIN, G.G. (1978). *Child Development*. Englewood Cliffs, NJ: Prentice-Hall. Focuses on developmental processes in childhood and adolescence from a life-span view.

FISHER, S., & FISHER, R.L. (1977). *What We Really Know About Child Rearing*. New York, NY: Basic Books. Effectively converts research from laboratory and clinic settings into "how to" advice for parents.

FRATBERG, S. (1968). *The Magic Years*. New York, NY: Scribner. A well-done description of childhood from the point of view of an understanding adult. Includes a look at the thinking processes and cognitive world of children.

NEWMAN, B.M. & NEWMAN, P.R. (1978). *Infancy and Childhood: Development and Its Contexts*. New York, NY: John Wiley. A well-illustrated college-level text depicting human development in a variety of contexts: in the uterus; in the family; and in day-care centers, schools, and neighborhoods.

SPOCK, B. (1977). *Baby and Child Care, ?? ed.*. New York, NY: Pocket Books. The classic guide on almost any behavioral or physical problem encountered in raising a child.