CHAPTER 3

THE FIRST TWENTY-FOUR MONTHS

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SUMMARY AND THEORETICAL IMPLICATIONS

The Infant at Birth

▲ Photo 3.1 The infant is wearing headphones. At what age do you think that infants typically start listening closely to speech sounds and music?

According to the view that the infant comes into the world as a *tabula rasa,* or blank slate, one would expect the infant to come into the world knowing nothing. Research suggests that this extreme view is incorrect. Children come into the world with some pretty amazing inborn behaviors. For example, they come equipped with reflexes, which are the result of innate mechanisms. Table 3.1 describes some of these reflexes. At birth, all infants display the stepping reflex, which occurs when infants' feet come in contact with the ground or a hard surface. Infants lift their feet and make a walking motion. Infants are not strong enough to support their weight on their legs and feet; thus, walking is not actually possible by the infant. By the third month of life, the stepping reflex disappears. All infants also display the crawling reflex, which occurs when infants are placed on their stomachs. They move their arms and legs in a crawling motion. The reflex disappears by the age of 2 months. Later in development, most infants go on to crawl before they walk; however, some

Table 3.1 Some of the Reflexes Observed Universally in Newborns

Reflex	Description	Disappears
Sucking reflex	When roof of infant's mouth is touched, lips will close and sucking will occur	About 2 months
Crawling reflex	When placed on stomach, infant's legs will make a crawling motion	About 2 months
Startle reflex	Infant will cry when losing support and falling or when a loud sound is heard	About 3 months
Stepping reflex	When feet touch the ground or a surface, infant will lift feet and make a walking motion	About 3 months
Babinski reflex	When side of foot is touched, toes will fan out and foot will turn inward	About 4 months
Rooting reflex	When cheek is touched, infant will turn in the direction of the touch	About 4 months
Palmar grasp	When palm is touched by a finger, infant will grasp the finger	About 6 months
Gag reflex	Prevents choking	Does not disappear
Right reflex	Head will be lifted when placed on the stomach to clear nose and mouth	Does not disappear

Source: Levine and Munsch (2011).

infants skip the crawling phase altogether. Those infants who do crawl devise numerous ways to achieve it (Arlitt, 1946).

Noam Chomsky, the founder of the generative approach, has compared learning language to learning to walk (Chomsky, 1959). No one teaches a child to walk; however, the physically healthy and normally developed children will eventually discover their ability to do so. Most parents will vividly recall their child's first step. In many cases, children will spend days or weeks pulling themselves up and standing. After some experimenting, the child is off and walking, taking the first few wobbly steps. Similarly, Chomsky claimed that the infant comes into the world with the physical mechanisms in place necessary for language to emerge (Searchinger, Male, & Wright, 2005). Table 3.2 displays the language development milestones for the first 24 months.

Table 3.2 Timeline of Selected Language Milestones From Birth to Twenty-Four Months

Milestone	Average Age
Facial imitating	At birth
Social smiling	6 weeks
Cooing	6 to 8 weeks
Babbling	4 to 6 months
Gesturing	8 to 10 months
Saying first words	10 to 12 months

Source: Adapted from Brown (1973).

Infants are, in fact, remarkably capable at birth and soon after birth. Many of their abilities appear to be related to, at least in part, inborn knowledge. The remainder of this section will review infants' ability to imitate, to see, and to hear. Infants' hearing ability is particularly well developed, as they are able to perceive the entire range of possible human speech sounds.

Imitation

Infants are well equipped at birth to imitate the facial expressions of others. Being able to imitate facial expressions can aid in learning how to produce speech sounds. In their now classic study, Meltzoff and Moore (1983) showed that newborns who are only minutes old can imitate facial expressions of strangers. They showed that infants who had viewed only one or two human faces in the minutes following birth could imitate facial expressions. The logistics of how the study was done is almost as interesting as the study's results. The research team received permission from a group of expecting mothers prior to the delivery of their infants. The research team made sure that they were in the hospital when the mothers arrived in labor. Soon after the delivery, the researchers were allowed a brief time with the infant. During testing, a member of the research team made a series of facial movements and videotaped the responses of the newborn. These videotapes showed that infants had no problem matching the researcher's facial expression. The photos displayed in Figure 3.1 were taken during a similar study carried out on infants who were between 12 and 21 days old (Meltzoff & Moore, 1977). The three facial expressions that were successfully imitated were (1) the tongue protruding, (2) the mouth opened in a circle, and (3) the lips protruding.

The fact that infants can imitate others so soon after birth suggests that imitation requires little or no learning. Today, researchers believe that there are specialized cells

Figure 3.1 Infants were able to imitate a stranger's facial expressions. The stranger in the photo is the researcher Andrew Meltzoff

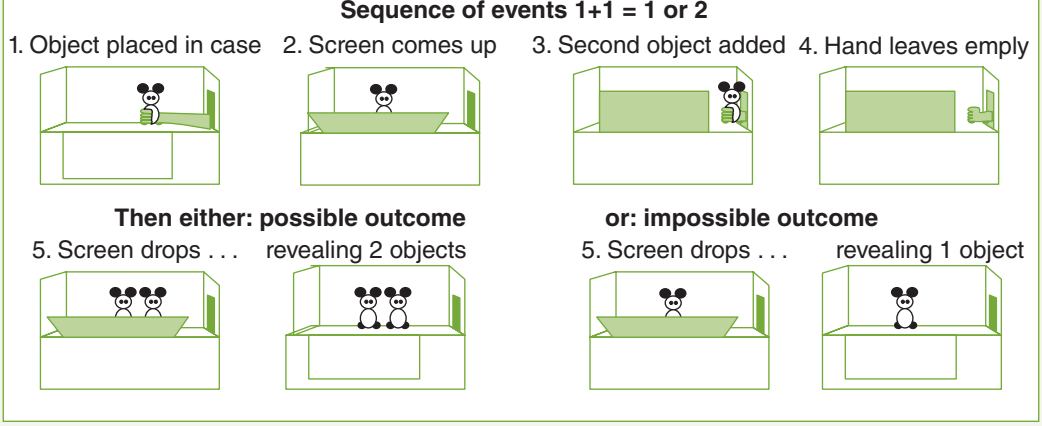
or neurons in the brain that may explain the ability of humans to imitate others so easily. These cells are called **mirror neurons.** They were first reported in 1992 by neuroscientists studying macaque monkeys (Di Pellegrino, Fadiga, Fogassi, Gallese, & Rizzolatti, 1992). The researchers discovered specialized neurons in the brain that responded when the animal observed another performing an act and when the animal itself performed the act, such as putting something to its mouth. The research on the functioning of mirror neurons in animals and humans is in its beginning stages. There are many questions that remain unanswered. For now, their existence provides an intriguing possible explanation for infants' imitative skills. Infants demonstrate other extraordinary abilities as well. Text Box 3.1 describes the research that discovered yet another way in which infants are extraordinary: They can add and subtract.

The fact that newborn infants can imitate faces is even more amazing when one considers the fact that at birth, the infant's visual system is not fully developed (Vital-Durand, Atkinson, & Braddick, 1996). At birth, their vision is about 20/400, which for an adult would be legally blind. At birth, infants cannot see color, only shades of gray, and their eyes cannot focus on objects that are near them. Parents may notice that sometimes infants' eyes do not appear to be moving together. It takes several months for infants' eyes to become well coordinated. By the age of 6 months, infants' vision is typically 20/25, which is almost as good as an adult with perfect vision (i.e., 20/20). Between birth and 6 months, infants can develop their visual skills faster if they experience an interesting variety of visual stimuli. The American Optometric Association (AOA) (2011) has

Text Box 3.1 Extraordinary Individuals: Infants Can Add and Subtract?

Long before infants can say the numbers *one, two, three,* they show an understanding of adding and subtracting. In the experiments conducted originally by Karen Wynn (1992) and replicated by several others (Simon, Hespos, & Rochat, 1995; Uller, Carey, Huntley-Fenner, & Klatt, 1999), infants as young as 5 months of age were seated on a caregiver's lap in view of a small stage on which a toy mouse was placed. A screen was lifted between the infant and the stage. The infant then saw a research assistant place a second toy mouse behind the screen. The screen was then lowered, allowing the infant to see the stage. On some trials, the stage held the two toys. On some trials, the stage held just one toy. The researcher measured how long the infant looked at the stage when the screen was lowered. They found that the infants looked longer when they saw only one toy on the stage, indicating that the outcome violated an expectation of seeing two toys. Figure 3.2 displays the sequence of events that occurred in the study. The researchers also carried out trials in which infants' subtraction ability was tested. Two toys were initially placed on the stage. The screen was then raised, and the researcher removed one of the toys. When the screen was lowered, either one or two toys were present. Infants, again, looked longer when the unexpected outcome occurred. These and other similar results demonstrate that children appreciate the individuality of small numbers of objects and use that knowledge when evaluating what they see.

Figure 3.2 Experimental manipulations, testing infants' ability to add and to subtract



Source: Wynn (1992).

recommended that parents routinely change their infants' environment by changing the location of the crib. Many decorations for infants' rooms and mobiles now come with vibrant colors and interesting geometric shapes. These decorations may be helpful as infants learn how to see.

Hearing

At birth, the hearing of infants is particularly well developed. There is some reduction in hearing due to the fact that the middle ear may contain fluid. As the fluid dissipates, hearing improves. Hospitals routinely test newborns' hearing before they are allowed to leave the hospital (Northern & Downs, 2002). Two tests are routinely used. The first test is the **otoacoustic emissions test,** or OAE. A small earphone and microphone are placed in the infant's ear canal. Sounds are played. When an infant hears normally, an echo is produced. If an infant is hearing impaired, then no echo will be observed. The second test is a test of **auditory brainstem response,** or ABR. Small electrodes are placed on the infant's head, and the electrical activity is recorded as the infant listens to sounds. Before these techniques were developed, deaf or hearing impaired infants were diagnosed much later when they were discovered to be unable to respond to environmental sounds, such as their parents calling their names.

Even with the fluid in the middle ear, infants are quite sophisticated hearers. Newborns are able to distinguish speech sounds from all the world's languages—even the speech sounds that do not occur in the language(s) spoken in their environment (Eimas, Siqueland, Jusczyk, & Vigorito, 1977; Jusczyk, 1999). Infants' perceptual abilities are quite extraordinary, considering that it has been estimated that across the world's languages, there are about 600 consonants and 200 vowels (Ladefoged, 2001). Infants appear to come into the world equipped to handle any speech sound that they might hear. During the first year of life, infants come to learn how to produce the speech sounds that they hear regularly.

The phonemes that infants of English-speaking parents hear and learn to produce are displayed in Table 3.3 along with their phonetic symbols. In English, there is a loose relationship between spelling and pronunciation, which can make the discussion of phonemes more challenging for speakers of English than speakers of languages in which the relationship between sound and spelling is unambiguous. In English, the spelling of a word may only partially indicate how the word is to be pronounced. Some letters, such as *c,* are associated with more than one pronunciation. The *c* in *car* is pronounced as a /k/, but the *c* in *receive* is pronounced as /s/. The word **grapheme** is used to refer to the spelling of a word or phoneme. In English, graphemes are letters. In other languages, such as Chinese, graphemes may be either an entire symbol or a portion of a symbol (e.g., 鸟 is the symbol *bird*). English is likely the most complicated language to spell, because the spelling-to-sound or **grapheme-to-phoneme correspondences** are so variable. One reason is that English has been a written language since before the 10th century. Many words with unusual grapheme-to-phoneme correspondences are borrowed by other languages or represent a period of time in the English language that had grapheme-to-phoneme correspondences that were different from those that are productive today. The poem "Our Strange Lingo" in Table 3.4 illustrates the complexities of English spelling.

Table 3.3 Phonetic Symbols for Consonants and Vowels in American English

Consonants				Vowels	
Top	/t/	Choke	/ tʃ /	Eat	/ i: /
Dig	/d/	Shake	/ ʃ /	Ate	/ eI /
Pot	/p/	Joy	/dʃ /	Shoot	/u:/
Bat	/b/	Measure	/ʒ/	Goat	/ o ʊ /
Mat	/m/	Wife	/w/	Rat	/æ/
Nap	/n/	Yes	/y/	Cut	/ ʌ /
Fun	/f/	Sing	/ŋ/	Kite	/ a ʌ /
Van	/v/	Uh-oh	/?/	Boy	/ʌj/
Sit	/s/	Look	/l/	Lit	/I/
Zoo	/z/	Ram	/r/	Set	/ʌ/
Kiss	/k/			Foot	/ʌ/
Game	/g/			Caught	/ʌ:/
Those	/ ð/			Pot	/a/
Think	/ θ/			Uh	/au/
Home	/h/			Pout	/aw/

Source: Glucksberg and Danks (1975).

In the now-classic study that showed that infants can distinguish phonemes that do not occur in their native language, Eimas and colleagues (1977) utilized the head-turn technique, which you learned about in Chapter 1. Infants were trained to turn their heads when they heard a target speech sound. A variety of speech sounds were played. Of interest in this study and similar studies was the extent to which infants could distinguish pairs of speech sounds that differed in a minimal way, such as /p/ versus /b/, /t/ versus /d/, and /k/ versus /g/. These pairs of consonants differ only in one feature—**voicing**, or the presence of vibration in the vocal cords. The consonants /b/, /d/, and /g/ are all voiced consonants because they are produced with voicing. The consonants /p/, /t/, and /k/ are voiceless consonants because they are produced without voicing.

Categorical Perception

Infants' ability to distinguish speech sounds is described as **categorical perception,** which means that the hearer perceives most sounds as one phoneme or the other despite the fact that the sounds vary systematically along an acoustic continuum. For example, the sounds /pa/ and /ba/ are perceived by English speakers as referring to different speech sounds—/p/ as in *pat* and /b/ as in *bat*. Acoustically, there is only a small difference between the two

Table 3.4 The Spelling Oddities of English Are Wonderfully Manipulated in a Poem

Our Strange Lingo

Our Strange Lingo When the English tongue we speak.
Why is break not rhymed with freak?
Will you tell me why it's true
We say sew but likewise few?
And the maker of the verse,
Cannot rhyme his horse with worse?
Beard is not the same as heard
Cord is different from word.
Cow is cow but low is low
Shoe is never rhymed with foe.
Think of hose, dose, and lose
And think of goose and yet with choose
Think of comb, tomb and bomb,
Doll and roll or home and some.
Since pay is rhymed with say
Why not paid with said I pray?
Think of blood, food and good.
Mould is not pronounced like could.
Wherefore done, but gone and lone—
Is there any reason known?
To sum up all, it seems to me
Sound and letters don't agree.

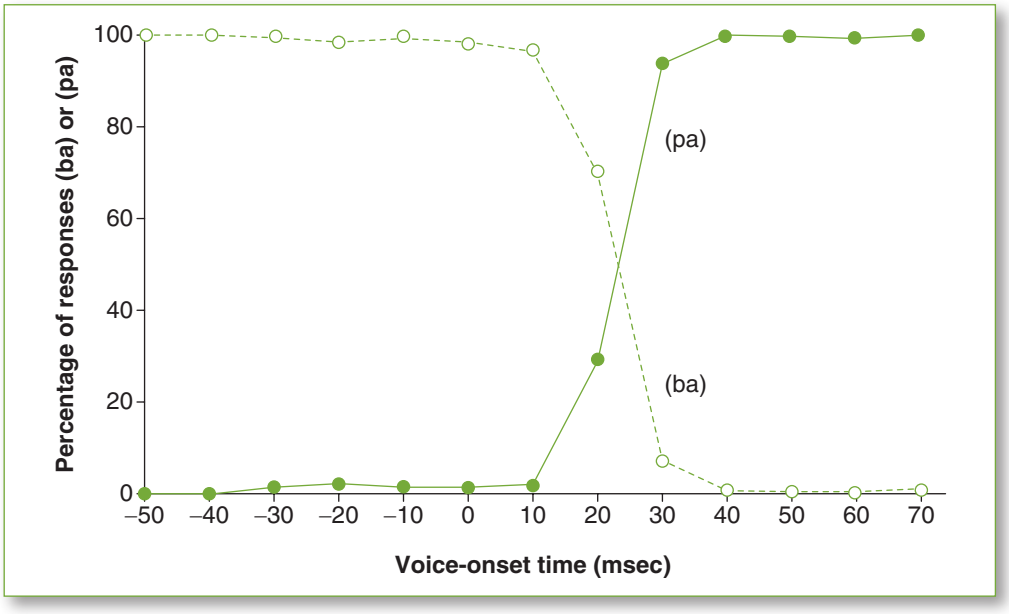
Source: Cromer (1902).

sounds. The difference is found in the amount of silence that occurs right after the sound begins. Both sounds begin with a closing of the lips. During the production of a /b/ in English, the vocal cords vibrate, causing there to be only a small amount of silence following the beginning of articulation. The amount of time between the beginning of articulation for a consonant and when the vocal cords begin to vibrate is called **voice-onset time.** During the production of a /p/, the vocal cords do not vibrate, and there is a longer amount of silence following the beginning of articulation. If there are 25 milliseconds or more of silence, the sound is generally perceived as /p/; otherwise, it is perceived as /b/ (Wood, 1976). Figure 3.3 displays the relationship between amount of voice-onset time for the /p/ to /b/ continuum and the percentage of /b/ to /p/ responses.

Consonants can vary in terms of other features, besides voicing. They can differ in terms of **place of articulation** or where in the vocal tract the airflow is interrupted. For example, some consonants are created when the airflow is interrupted at the lips. These consonants, which include /p/, /b/, and /m/, are referred to as **labial consonants.** Consonants can also differ in terms of **manner of articulation,** or the extent to which the airflow is completely or only partially stopped during the production of the sound. Consonants that involve a complete interruption of airflow are called **stop consonants,** as in /p/, /b/, /t/, /d/, /g/, and /k/. In contrast, the consonants /f/ and /v/ are produced when the air is permitted to flow between the lips and teeth. Consonants produced when airflow is partially stopped between any two places of articulation (e.g., lips, teeth, or palate) are classified as **fricatives.** Figure 3.4 displays the human speech tract. During the production of speech, the airflow can be interrupted at many points along the route from the larynx to the lips.

Later research showed that the ability to distinguish speech sounds is not unique to human infants. Other animals, such as chinchillas, can also do this (Kuhl, 1987). Both infants and chinchillas (and likely other animals) demonstrate categorical perception. Unlike chinchillas, by the end of the first year of life, infants lose the ability to distinguish those speech sounds that do not occur in their environment (Jusczyk, 1999). One of the earliest studies by Werker and Tees (1984) showed that infants gradually lose the ability to perceive

Figure 3.3 Relationship between voice-onset time and perception of /b/ to /p/



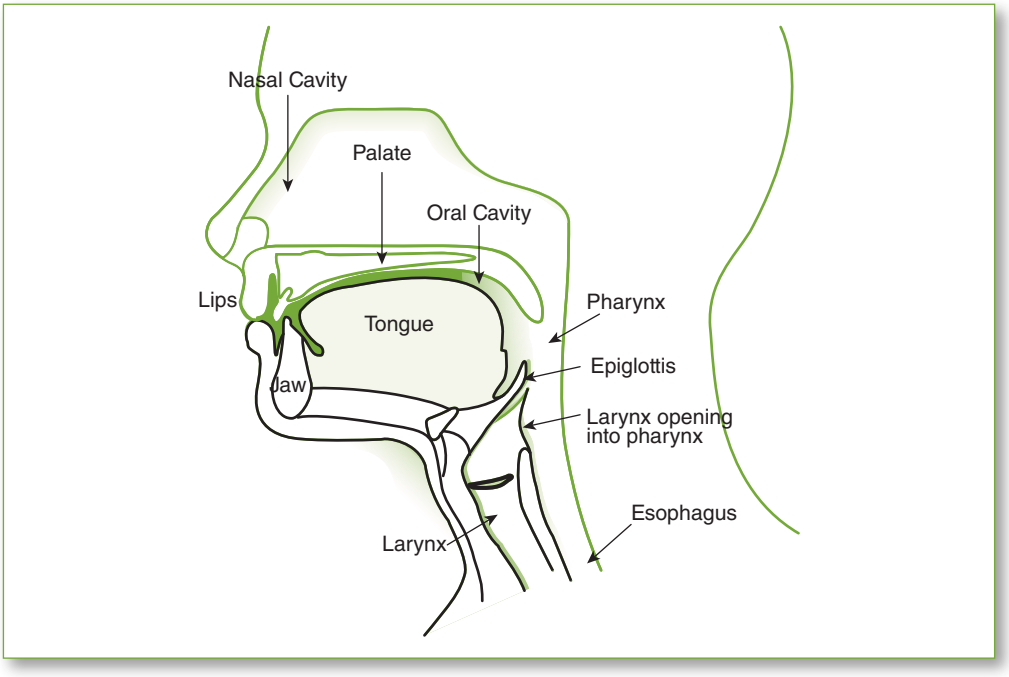
Source: Adapted from Wood, C. C. (1976).

phonemes that they do not hear in their environments. In the study, infants of English-speaking mothers heard pairs of consonants that varied in voicing. Some of the consonant pairs never occurred in English. They were consonants that occur in Hindi and also in Inslekepmx, a language that is spoken in British Columbia. The results showed that all infants between 6 and 8 months of age could distinguish these phonemes, but few infants between the ages of 10 and 12 months could. In follow-up studies with infants whose mothers spoke Hindi, a language spoken in India, all of the 10- to 12-month-old infants could distinguish the sounds. These results and others like them demonstrate that the infants' perceptual abilities rapidly tune to their environment. Over time, infants lose the ability to distinguish contrasts that they do not hear. Recent research has shown that Japanese infants can distinguish the English phonemes /l/ and /r/ early in life but gradually lose that ability between 6 and 12 months of age (Kuhl et al., 2006). American infants raised in English-speaking environments have also been studied. They also lose the ability to distinguish phonemes that do not occur in English between the ages of 6 and 12 months (Kuhl, 2007).

Auditory Adaptation

Research by Patricia Kuhl and colleagues (Kuhl, Conboy, Padden, Nelson, & Pruitt, 2005) has shown that there may be a relationship between how quickly infants' perceptual abilities adapt to the language(s) in their environment and their later language development. In two

Figure 3.4 The diagram depicts the parts of the human speech tract. During the production of speech sounds, the airflow can be interrupted at numerous points from the larynx to the lips



Source: Retrieved from http://en.wikipedia.org/wiki/Motor_theory_of_speech_perception

studies so far, they found that infants who demonstrated better performance when perceiving contrasts in their native language than when perceiving contrasts from other languages showed better performance in word comprehension later. They measured performance at 14, 18, 24, and 30 months (Kuhl et al., 2005). One implication of this research is that infants may, one day, be tested relatively early in life in order to predict their later word-learning aptitude. Although this type of intervention may take many years to develop, the hope is that infants showing delays in tuning into their native language sounds could be assisted through special learning sessions to improve their perceptual abilities.

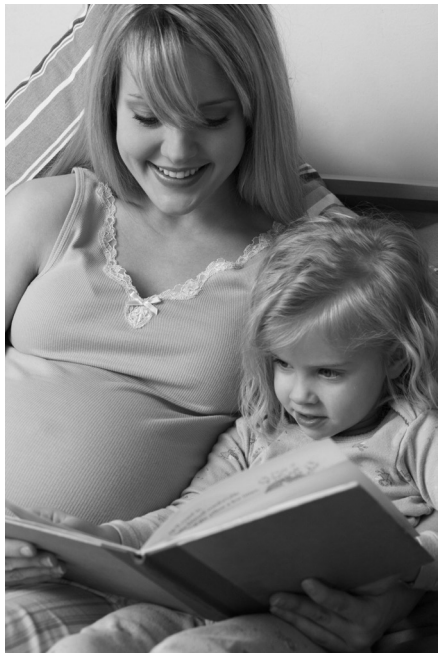
When Does Learning Begin?

Although the imitative and perceptual abilities of infants demonstrate that infants are far from *blank slates* at the time of birth, infants have a great deal to learn after they enter the world. The knowledge that they gain becomes part of their memories, first starting out as a sensory memory, such as a sound or visual image, before becoming a long-term memory. One of the amazing facts about infants is that they begin forming long-term memories

even before they are born. The best evidence that infants form long-term memories before birth comes from studies investigating infants' memories for sound. We know that infants can hear before they are born, because expectant mothers sometimes report feeling fetal movement when there is a loud sound in the environment. Studies have shown that fetuses only 26 weeks old (6.5 months) can respond to environmental sounds (Kisilevsky, Muir, & Low, 1992).

A substantial body of research has shown that infants' experiences before birth are remembered and can influence their behavior after birth. Research by Spence and DeCasper (1987) found that infants prefer to listen to actual human speech as compared with speech that has been altered by a computer (Spence & DeCasper, 1987). They also prefer to listen to regular speech versus speech that is played in reversed order (Peña et al., 2003). Studies have also shown that infants can distinguish their mother's voice, which they have heard through the womb during pregnancy, from the voices of unfamiliar others (DeCasper & Fifer, 1980; Kisilevsky et al., 2003). Fetuses are likely to form their best auditory memories of the mother's voice, because it is the only sound that is transmitted from within the mother's body (Petitjean, 1989). Infants can also distinguish between auditory samples of their mother's language and samples of other languages (Mehler et al., 1988). In a study by Moon, Cooper, and Fifer (1993), 2-day-old infants demonstrated a preference for their native language. These studies and others like them do not mean that infants understand a particular language; rather, the sound and rhythm of the language are familiar to them due to their prior exposure to the language.

Studies with infants have also demonstrated that they form memories of specific auditory events that occur before birth. In a particularly clever study, it was shown that infants formed memories for chunks of specific language that they heard before birth. DeCasper and Spence (1986) recruited a group of pregnant women to read a part of a story every day during the last 6 weeks of their pregnancies. When the infants were born, the researchers compared infants' responses to the previously heard passage and responses to a passage that had never been read by the mother. The results showed that the infants responded differently to the familiar passage than the novel one. In contrast, a control group of infants whose mothers did not read the target passage during pregnancy responded to the target and novel passages similarly.



▲ Photo 3.2 After 26 weeks' gestation, the fetus can hear sounds occurring outside of the womb. Do you think it would be useful for expectant parents to talk to their unborn baby?

Types of Memory

In both children and adults, there are multiple types of memories that can be formed (Ashcraft

& Radvansky, 2009). Memories for specific events that one experiences are called episodic memories (also called autobiographical memory). For adults, episodic memories might include birthday parties, experiences with family and friends, and notable occasions, such as graduating from high school. The memory contains details of the episode as it was experienced. In contrast, memory for factual knowledge, such as the knowledge learned in school, is called **semantic memory.** One's knowledge about the meanings of words would be included in semantic memory. Most of the research on long-term memory has been conducted on adults. In that work, researchers refer to memory that we know we have and usually can talk about as explicit memory. Memory that we may not know we have stored is called implicit memory. An example of implicit memory would be memory for how to ride a bike or memory about how to punch in numbers on a phone keypad to call a particular person. These memories for how to perform specific tasks are examples of procedural memory.

The exact nature of the memories that infants first form is unclear. It is also not clear how infant memory develops over time. The nature of the memories formed soon after birth may differ from the memories formed later in life, such as when the child is learning facts in school. What is clear is that memories begin to form not only before birth but soon after birth as well. Swain, Zelazo, and Clifton (1993) conducted a study with infants only 24 hours old and showed that they demonstrated long-term memory for speech sounds. They first tested the infants when they were 24 hours old and had them listen to the speech sounds. They tested the infants 24 hours later, using a variation of the head-turn procedure. The infants responded differently to sounds that they had heard the previous day than to unfamiliar sounds. Prior to that study, there was no evidence that infants formed memories that lasted longer than a few minutes.

The Earliest Memories

While we know that infants form memories before birth and soon after, there is still a great deal that we do not know about how memory develops in the first 24 months of life and beyond. Most adults are not able to report many memories for early childhood. The term ***childhood amnesia*** has been used to describe the fact that most of our childhood experiences are forgotten. Early research has suggested that most of the early childhood memories remembered by adults occurred between 2 and 3 years of age (Usher & Neisser, 1993). More recent research has attempted to identify the age at which the childhood amnesia wanes, which is the age at which one has memories for life events. The age is estimated to be between 3 and 5 years (Multhaup, Johnson, & Tetirick, 2005). The causes of childhood amnesia are not known. It may be that memories formed before one is able to verbalize one's experience are not stored in memory very well or are not easily retrieved from memory. Another possibility is that the changes occurring in the child's brain due to growth and maturation make it difficult to access memories formed early in life. It may be a combination of these possibilities as well as causes not yet discovered.

Most, if not all, of the memories formed in the first year of life are not remembered later in life. It is only through carefully designed studies that researchers have been able to obtain evidence that memories are formed. Mandel, Jusczyk, and Pisoni (1995) showed that infants 4.5 months of age preferred listening to their own names. Infants

show a preference for listening to familiar words, such as cup and spoon, versus unfamiliar words by the age of 7.5 months (Jusczyk & Aslin, 1995). Infants who are 10 months old are able to recognize words that they have heard before in a laboratory environment (Jusczyk, 1997) (see Table 3.5).

Table 3.5 Milestones of Lexical Development

Milestone	Age
Perceiving speech	6 to 8 months
Recognizing familiar speech sequences	8 to 10 months
Preferring familiar words	10 to 12 months
Learning to associate words with objects	12 to 14 months

Source: Based on Werker and Tees (1999).

What Role Do Adults Play in Infants' Language Development?

When one takes an informal poll of friends and family and asks how they think children learn language, one tends to find that the most frequently cited answer is that parents teach children to talk. The idea that development is influenced by the social environment, which is a central assumption of the social-interactionist approach to language development, was influenced by Lev Vygotsky (1896–1934), a prolific researcher and theorist. He was born in Orsha, in modern-day Belarus. He emphasized the role of social processes in child development, particularly language development (Lee & Smagorinsky, 2000). He coined the term *zone of proximal development* to describe those tasks that children can carry out themselves and those tasks that children can complete with some help from adults. He viewed the zone of proximal development as a continuum with the lower part of the range including the activities children can carry out independently and the upper part of the range including the more complex activities that children can accomplish with assistance from another. He believed strongly that play was a critical activity in development, enabling a child to engage in abstraction, a key element of cognitive development. He also recognized the strong connection between language and thought. He pointed out the relationship between oral speech and inner speech, which refers to the voice in our minds that we can sometimes experience when we are thinking to ourselves. He believed that language, specifically oral language, is first used by the child for social interaction and occurs when thought is turned into speech. In contrast, inner speech develops as a way to direct one's own behavior and occurs when one turns speech into thought. Perhaps, his most significant contribution is the idea that children acquire knowledge through social interactions, which inherently involve cultural knowledge. The process of *internalization* is used as children learn how to carry out activities in the context of the social environment or culture. He wrote extensively, publishing six volumes of work over a 10-year period. Considering his early death at the age of 34 from tuberculosis, one cannot help but wonder what he could have accomplished had he lived longer.

Today, many researchers find the work of Vygotsky relevant, particularly when considering how infants acquire language. Certainly, parents and other caregivers play some role in children's learning; however, the important question is what exactly their role is. Those who believe that language development occurs as it does because of innate mechanisms

believe that the role of parents and caregivers in language learning is overstated (Pinker, 2007). There are ways in which adults interact with children that may be beneficial to children—either in their survival or their language learning or both.

Infant-Directed Speech (Motherese)

When most adults talk to infants, they adopt a way of talking that is different from how they would talk to another adult or teenager. They may use a high-pitched voice and an exaggerated intonation. When speaking to infants and small children, adults typically use short sentences and repeat key words (e.g., Hey there. Look at you! You are a happy baby. Yes, you are. Who's the happy baby? You are!). In English, the phrase *baby talk* is used to describe this manner of speaking. Among language development researchers, the terms ***motherese*** (Newport, Gleitman, & Gleitman, 1977) and ***infant-directed speech*** are used.

Careful examination of samples of motherese shows that it provides the infant with excellent examples of vowel sounds. The vowel sounds produced in motherese are typically stretched out, produced over a longer duration, and also particularly good prototypes for the vowel (Kuhl, 1999). Motherese may also help infants start to identify word boundaries in speech (Thiessen, Hill, & Saffran, 2007). The research investigating how infants use motherese supports the **phonological bootstrapping hypothesis,** which claims that language learning is aided by the infants' analysis of the characteristics of the speech that they hear (Morgan & Demuth, 1996). The more specific **prosodic bootstrapping hypothesis** suggests that the prosody or melody of the speech stream provides the infants with information about language that aids them during acquisition. The prosody of speech may provide information that infants can use to identify the beginnings and endings of words as well as the beginnings and endings of clauses and phrases. Furthermore, infants may use information about stress patterns within words to identify the beginnings and endings of syllables. There is evidence that infants are sensitive to the different types of adult speech (i.e., motherese vs. speech used between adults). Research has shown that infants actually prefer to listen to motherese over regular, adult-directed speech (Cooper & Aslin, 1990; Fernald, 1985).

▲ Photo 3.3 Around the world, the speech used to address infants is acoustically different from the speech used to address adults. Do you speak differently when you talk to a small child versus one of your peers?

Motherese Across Cultures

Motherese appears to be used all around the world in many cultures (Bryant & Barrett, 2007; Fernald et al., 1989; Grieser & Kuhl, 1988). The ability of infants and adults to identify the meaning of the motherese may be a product of natural selection, serving in some way to promote the survival of our species (Fernald, 1982). Darwin was the first to suggest that the expression of human emotion is the same across all humans (Darwin, 1872/2007). In 1971, Ekman and Friesen obtained convincing evidence for Darwin's view. The six universal expressions that all people can easily identify are sadness, happiness, anger, fear, surprise, and disgust. Fernald (1989) showed that adults listening only to the intonation of motherese utterances can distinguish those expressing approval from those expressing prohibition. In a recent study, Bryant and Barrett (2007) showed that samples of motherese can be readily distinguished from adult-directed speech by those who do not speak the language. They played American English samples of motherese and adult-directed speech to Shuar adults. The Shuar people are indigenous to Ecuador. The motherese or adult-directed speech expressed one of four meanings: (1) approval, (2) comfort, (3) attention, and (4) prohibition. The Shuar adults were highly accurate in distinguishing motherese from adult-directed speech. They were accurate in distinguishing the intentional content of the four categories of motherese but were less able to distinguish them in adult-directed speech.

If motherese is necessary for language development to occur, then one would expect that in cultures in which motherese or child-directed speech occurs infrequently, children would have trouble learning language. In fact, there are cultures where children are not generally spoken to before they can talk, and those children learn language in a timely fashion. The example of such a culture is the !Kung San people who live in the Kalahari Desert in Angola, Botswana, and Nambia. The !Kung San live in small groups of 10 to 30 people in a semipermanent camp located near a water source. They speak the !Kung language, which is spoken using click phonemes that do not occur in English or other Indo-European languages. The main character in the film *The Gods Must Be Crazy* is !Kung San. For thousands of years, they have followed a hunting and gathering lifestyle, eating meat provided by the men who hunt and roots, nuts, and berries that women gather. Women who give birth do so alone away from the camp. They return to work within hours after delivery. Giving birth in this manner gives women a sense of pride. The child-rearing practices of the !Kung San are particularly compelling and informative on the topic of language development. Children are not spoken to until they can talk (Konner, 2002; Pinker, 2007). This is not out of indifference to children. To the contrary, mothers are attentive caregivers. They carry their infants close to their bodies about 90% of the day and respond immediately to their crying. Studies have shown that !Kung San mothers respond to their crying infants more rapidly than mothers in the United States. The fact that !Kung San children acquire language fully and in a similar time frame as other children in the world has been cited as evidence that caregivers play a limited role in language development.

The evidence that child-directed speech is not the magic bullet in explaining language acquisition should not be taken to imply that parents and caregivers play no role in language development. Recent research suggests that infants' categorical perception can be influenced by the social environment (Kuhl, 2007). In a study in which American infants reared in

English-speaking environments were taught Mandarin speech sounds, Kuhl and colleagues (Kuhl, Tsao, & Liu, 2003) found that infants learned when a person or tutor was in the room but not when the tutor's image was delivered on a television screen or when the infant only heard the sounds without the presence or image of the tutor. The results are among the first to demonstrate that the presence of a person strongly facilitated infants' learning. The authors suggest that the presence of a person can increase the infants' attention during learning, leading infants to make better use of the acoustic characteristics of the speech sounds.

Motherese in Signed Languages

Research has shown that motherese is not just a phenomenon observed in spoken languages. Mothers who communicate with their infants using signed languages also display different signing behaviors with their infants than with adults. Masataka (1992) recorded interactions of eight mothers who were deaf and users of Japanese Sign Language as their first language when they were interacting either with their deaf infants or with a deaf adult. The results showed that mothers signed differently with infants than adults. When they signed to their infants, they signed more slowly, repeated signs, and used exaggerated movements in the execution of the signs. In a follow-up study, Masataka (1992) showed that when presented with signing that was intended for infants and signing that was intended for adults, deaf infants preferred the former.

First Communications

When Do Infants Begin Communicating?

For the first weeks of life, infants spend most of their time sleeping, around 16 to 18 hours a day. They cry when they are hungry or physically uncomfortable. They will also make noises when they breathe and eat. Such sounds are called **vegetative sounds.** Before the age of 6 weeks, the only sounds that infants typically make are cries and vegetative sounds. After the age of 6 weeks, infants begin to produce cooing, which consists of pleasant-sounding vocalizations, usually involving one elongated vowel (e.g., *oooooo* or *aaahhh*). Between 6 weeks and 12 months, children go from smiling to producing first words. By the middle of the second year, children typically have developed a vocabulary of several hundred words or more. The remainder of this section provides information about each of the important milestones that children experience during this time.

Social Smile

It's not until around 6 weeks of age that infants begin to show signs that they are recognizing others. Showing a sign of recognition can be considered a form of nonverbal communication. Around this time, when Mom or Dad enters the room, the infant might smile and appear pleased. This behavior is called the **social smile.** When infants begin smiling in response to a caregiver's presence, there is usually a clear sense that the infant recognizes the person and is happy that the person is there. Research shows that an infant does not need to see in order to display social smiles, as blind infants also produce social smiles, but

less often than sighted infants (Rogers & Puchalski, 1986). The blind infant may recognize the presence of caregivers through the other senses, such as the sounds of a voice.

When infants older than 12 weeks do not take interest in others, make eye contact, or display social smiles, there is some cause for concern. Such infants should be evaluated by a pediatrician because of the possibility of **autism** or some other developmental disorder. Autism is characterized by impaired social functioning. Autism is difficult to diagnose, particularly in very young infants. Children may not receive a definitive diagnosis until the age of 3. Infants with autism may also show delays in cooing and may not produce laughter, which emerges around 16 weeks. Because laughter requires quite a lot of muscle control, children with neuromuscular problems may also not produce laughter at the typical point in development (Gallagher, Jens, & O'Donnell, 1983).

Babbling

The first speech sounds that infants produce occur when they begin **babbling,** which involves the production of nonsensical sounds and sound sequences. When one listens closely to the young infants' productions, one finds examples of vocal play in which the infant produces a range of sounds. Some of the sounds are speech sounds; some are not, such as blowing a raspberry, which involves extending the tongue and blowing so that the lip vibrates against the tongue. As the infant comes to produce primarily speech sounds, vocal play turns into the first stage of babbling. Babbling involves the repetition of sounds in a sequence that usually involves consonant–vowel combinations (Oller, 1980; Stark, 1980).

There are two stages of babbling. Initially, the infant repeats the same consonant and vowel, such as *bababa* or *gagaga*. This stage is typically first observed when the infant is between 4 and 6 months old. This type of babbling is referred to as **canonical babbling.** By 11 to 12 months, infants will produce sequences of speech sounds involving different consonants and vowels, such as *bagadabaga* or *mabadagama.* The second stage of babbling is called **variegated babbling.** Around this time, infants will also produce intonation during babbling. The most easily recognizable intonation involves that used when one forms a question. The pitch of the voice rises at the end of the question. For declarative sentences, the pitch of the voice tends to fall at the end of the statement. Examinations of variegated babbling have found that infants' babbling increasingly takes on characteristics of the language(s) of the home. Brown (1958) referred to this phenomenon as **babbling drift.** By the time infants are about 10 months old, it is possible to distinguish the babbling of infants who have been raised in different language environments (Boysson-Bardies, 1993). Infants are likely to be able to imitate the speech sounds of those in their environment. Laboratory studies have shown that infants can be trained to imitate vocalizations by around 5 months of age (Kuhl & Meltzoff, 1982).

Babbling is not physically possible at birth. When an infant is born, the larynx, or voice box, is high in the throat, which allows the infant to breathe and eat at the same time. With a high larynx, one can produce vowel sounds but cannot articulate speech in which there are alternative consonant and vowel combinations. In the first 2 months of life, the infant's larynx descends, after which the infant is more capable of producing the types of syllables found in speech. With a descended larynx, the infant is also at a greater risk of having food enter the windpipe, causing choking. Some researchers have written about the fact that the

adaptive value of human language must have been quite great because it comes with a clear risk—one that can sometimes cause death.

Infants who are deaf or have hearing loss will babble; however, there are some differences between their babbling and the babbling of hearing infants (Stoel-Gammon, 1988). Deaf infants may utilize a smaller set of speech sounds than hearing children, including more sounds produced with the lips (i.e., labials), such as /p/, /b/, and /m/; nasal sounds, such as /m/, /n/, and /ŋ/; as well as sounds produced using a partial stoppage of the airflow during articulation (i.e., fricatives), such as /f/, /v/, /s/, and /z/. Deaf infants who are taught sign language babble with their hands. They produce a variety of nonsensical gestures involving the hands and arms (Naeve Velguth, 1996; Petitto & Marentette, 1991).

Despite the fact that language is unique to humans, babbling is not. Intriguing research by Elowson, Snowdon, and Lazaro-Perea (1998) has shown that babbling occurs in nonhuman primates. They studied pygmy marmosets, which are native to the Amazon jungle of South America. Adult marmosets have numerous calls that are used to signal to other marmosets about the presence of dangers. Observations made in a captive colony of marmosets showed that young marmosets produced seemingly random sequences of adultlike vocalizations in the absence of any dangers. The vocalizations appeared to increase interactions with the adult marmoset caregivers. The authors suggested that babbling in human infants may similarly serve to increase interactions between infants and caregivers, which may be adaptive because it may increase the likelihood of infant survival.

First Gestures

Smiling and vocalization are not the only ways in which infants can communicate with others. They can also use gestures. For example, infants learn to indicate *no* by moving their head side to side. They learn to indicate *yes* by moving their head up and down. They learn to wave goodbye to others or blow kisses to show affection. They will eventually learn that a shrug of the shoulders means I don't know. They may indicate that they want to be picked up by stretching out their arms toward someone. They might hold out an object to show or give it to another.

By the age of 11 to 12 months, infants point (Leung & Rheingold, 1981). The extent to which the pointing is carried out for the purposes of communication is in the eye of the beholder. Parents are likely quite good at interpreting the gestures and sounds produced by their infant. Researchers have spent quite a lot of time investigating what infants' gestures actually mean.

Infants' gestures and some of their vocalizations toward the end of the first year of life are likely produced for the purposes of communication. The critical feature of communication is intentionality on the part of the speaker. Austin (1962) proposed three stages in the development of communication, which provide some distinctions that are useful when thinking about infants' gestures. These are displayed in Table 3.6. Gestures and utterances without intention represent the infants' early productions and would be classified as belonging to the perlocutionary stage. The illocutionary stage would include communications having intentionality but falling short of being adultlike productions. This stage likely includes most of infants' first use of gestures with or without accompanying words.

Research has shown that not all of infants' pointing is for communication. Infants will point when no one else is with them (Delgado, Gómez, & Sarriá, 2009). By the 13th month of life, infants use pointing to direct the attention of others (Tomasello, Carpenter, & Liszkowski, 2007). Research conducted by Goldin-Meadow and colleagues has shown that

Table 3.6 Three Stages of Development of Communication

Stage		Age
Stage 1: Perlocutionary	No communicative intent	Birth to 10 months
Stage 2: Illocutionary	Has communicative intent Does not use adultlike forms	10 to 12 months
Stage 3: Locutionary	Has communicative intent Uses adultlike forms	12 months and older

Source: Based on Austin (1962).

early pointing behavior is related to later vocabulary development (Iverson & Goldin-Meadow, 2005; Özçaliskan & Goldin-Meadow, 2006). They have also shown that the earlier that children use gestures with words, the earlier they are likely to produce two-word utterances (Goldin-Meadow & Butcher, 2003; Iverson, Capirci, Volterra, & Goldin-Meadow, 2008; Iverson & Goldin-Meadow, 2005) Infants' ability to use gestures has led many new parents of hearing, pre-verbal infants to consider teaching their infant a small set of gestures to facilitate communication. Textbox 3.2 describes the popularity of baby sign language.

Text Box 3.2 Diversity of Human Languages: Baby Sign Language

Many new parents have taught sign language to their hearing infants. Because infants can learn to gesture before they can learn to speak, some have suggested that using *baby signs* could facilitate communication between preverbal infants and caregivers. Some of the signs that are taught include signs for *eat, more, drink, sleep,* and *all done,* among others. Early studies of the use of baby signs in hearing infants suggested that hearing infants can easily learn to use gestures for communications (Acredolo, Goodwyn, Horobin, & Emmons, 1999; Goodwyn, Acredolo, & Brown, 2000). The studies also suggested that there are several advantages experienced by infants who learned and used signs early in life as compared with other infants. They went on to develop larger vocabularies, showed enhanced mental development, and exhibited fewer behavioral problems, such as tantrums. Not all researchers agree about the benefits of baby sign language. An examination of the research supporting the benefits of baby sign language found that the studies from which the results were obtained were methodologically weak (Johnston, Durieux-Smith, & Bloom, 2005). The conclusion, then, is that the scientific evidence does not fully support the claims that infants who use baby signs will experience long-term cognitive advantages over infants who do not use baby signs. Nevertheless, there is no study to suggest that using baby signs causes harm. Most of the parents who use baby signs with their infants find them easy to use and also useful. Parents may want to explore the possibility of using baby signs with their infants and determine for themselves whether the experience is beneficial.

When Do Children Produce Their First Words?

Healthy infants will begin producing their first words at 10 to 12 months of age and will continue to add to their lexicons throughout their lives. Researchers have closely examined how infants begin the journey of building their lexicons. This research has found that initially there is quite a lot of initial variability. Some infants' first words are words of their own invention. They have not heard the word used by others in the way that they use the word. The terms ***protowords*** and ***idiomorph*** are used to refer to such inventions. For example, an infant may refer to a favorite food, such as cereal, as *mum mum*. With such examples, one might speculate that the word has come from sounds made during mealtime, such as *mmm*. The child might refer to a bed as *godi*. Parents may never figure out where the invented word's origin. The invented words may become part of funny family stories retold even when the infant is an adult. Some infants may create names for caregivers that only they use. Some families will come to use the invented name for the person, because it comes to be used so often and is used in such a positive, sweet context.

The First Ten Words

Infants' first 10 words can be quite variable. Harris, Barrett, Jones, & Brookes (1988) compared the first words of four children from the time that they were 6 months old until they were 24 months old. Among the first 10 words, *mommy* was used by three of the four children. Two of the four children produced *no, go, here, more, there, hello, bye-bye, teddy, moo,* and *shoe* or *shoes.* The remainder of the words produced by only one of the four children included *quack, buzz, boo, teddy, ball, wee, down, bee, choo-choo, doggy, car, brum, woof, baby, yes,* and a name. First words may be truly referential words, because they are used across many contexts and are generally used to refer to objects of that type. Often first words are context bound words, or words that are used only in a particular situation in which the objects being described are present. For example, a child may use the word *teddy* first only when the soft toy is present.

Only a few studies have investigated the extent to which children's first 10 words differ across languages. In a study of 32 infants reared with German as the first (and only) language, Kauschke and Hofmeister (2002) observed that the first 10 words included relational predicates (e.g., *oben* [up] and *wieder* [again]) and social terms (e.g., *hallo* [hi] and *nein* [no]) when the infants were between 13 and 15 months old. Later on, infants produced more nouns, verbs, and other types of words. In a large-scale comparison of infants learning English, Mandarin, or Cantonese, Tardif et al. (2008) compared the first 10 words learned between the ages of 8 to 16 months. The results revealed some similarities and some differences across languages. Words for people, sounds, and sound effects (e.g., *vroom*) were included in the earliest words learned by each group of children. The groups of children differed in terms of how early nouns and verbs appeared. English-speaking children produced far more nouns that verbs. Mandarin-speaking children produced far more verbs than nouns. Cantonese children produced a comparable number of nouns and verbs.

The First Fifty Words

As children become more skilled word learners and their vocabularies grow larger, they tend to learn more nouns than any other type of word. When researchers have closely examined the first fifty words that English-speaking children know, they have found that

40% to 60% of the words are nouns (Bates et al., 1994; Dromi, 1987; Goldin-Meadow, Seligman, & Gelman, 1976). Only about 3% of first-learned words are verbs (Caselli et al., 1995). Some have suggested that the nouns may not be universally dominant in children's early vocabularies. In some languages, the advantage of nouns over verbs is not as large as in English. In some languages, verbs may be more salient than they are in English. Tardif, Gelman, and Xu (1999) provided evidence for the salience of verbs in a study involving Mandarin-speaking children. Choi and Gopnik (1995) reported similar results from a study involving Korean-speaking children. No study has found that verbs are more frequent than nouns in children's initial vocabularies (Waxman & Lidz, 2006).

The Emergence of Words

How Do Children Build Their Lexicons?

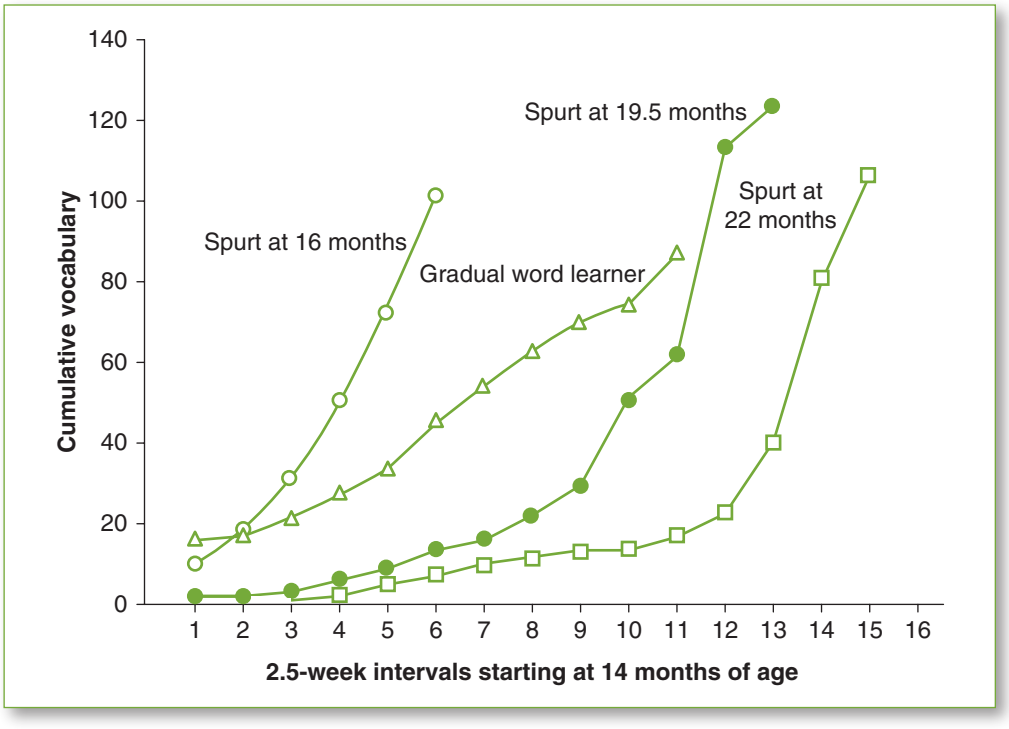
Researchers describe knowledge of vocabulary as the mental dictionary or lexicon. Children's lexicons grow one word at a time. By the age of 18, one usually has learned about 100,000 words, involving about 2,000 root words and words related to each root (e.g., for root word *write,* the related words could be *writes, wrote, writing, written, writer,* or *unwritten*) (Nation & Waring, 1997). A 5-year-old usually knows between 4,000 and 5,000 word families. On average, children in the United States learn approximately 1,000 additional word families each year. For anyone who has tried to learn a word a day to study for a standardized test, such as the ACT or SAT, one knows how hard it is for the teenager or adult to keep up with that pace.

The Word Spurt

Somehow, children are able to acquire an amazing number of new words without seeming to try. Around 18 months of age, the number of words that children know increases rapidly. The vocabulary may triple in size in a matter of only a few weeks. This has been referred to as the **word spurt.** There is individual variation in when a child will experience the word spurt. Figure 3.5 displays the vocabulary sizes for four children from 14 months to 22 months.

As children acquire new words, they may not use all of the words correctly. All children appear to make the same types of errors—a fact which suggests that the errors are likely to result from something general about human cognition. The first type of error is called an **overextension.** This error occurs when children use a word more broadly than an adult would. For example, a child may learn the word *dog* but use it to refer not only to dogs but also to cats, cows, horses, and birds. Eventually, the child will come to understand that a dog is a particular kind of animal and that other animals are called by other names. A second type of error is called an **underextension,** which occurs when children use a word in a more limited way than an adult would. For example, a child may use the word *hat* to refer to a particular hat but does not use the word to refer to any example of a hat. Research by Kay and Anglin (1982) showed that overextensions are less common than underextensions. Anglin (1986) also observed in his daughter a third type of error, which he called an overlap. His daughter would use a word that was underextended in one way but overextended in another. For example, she would use *brella* to refer to open umbrellas but also use it to refer to kites.

Figure 3.5 Rapid vocabulary growth for four children over 8 months from Goldfield and Reznick



Source: Goldfield and Reznick (1990).

Fast Mapping

The apparent ease with which children can learn new words can be explained by the process of **fast mapping**, which refers to children's ability to learn new words after one exposure (Carey, 1978). Fast mapping was convincingly demonstrated in a study in which children between 3 and 4 years of age were in a room with two trays: one blue and one a shade of olive green (Carey & Bartlett, 1978). The interviewer asked the child to *Get me the chromium tray, not the blue tray, the chromium one.* Children had no problem retrieving the olive colored tray. They demonstrated some knowledge of the word *chromium* even after 6 weeks. Halberda (2003) has shown that fast mapping occurs in 17-month-old infants. Golinkoff, Hirsh-Pasek, Bailey, and Wenger (1992) demonstrated that 30-month-old infants could acquire six new words via fast mapping in one experimental session.

The Original Word Game

▲ **Photo 3.4** Children learn many new words by asking adults, *What's that?* This strategy has been called the *original word game.* Have you spent time with a toddler who asks a lot of these types of questions?

The social context is also important as children learn new words. As children grow more verbal in the second year of life, they aid in their own word learning by requesting information from parents and others in their environments. Children will ask, What's that? Anyone who has been around a toddler of this age is likely to make note of how exhausting it can be when a child asks what's that? throughout the day. Usually, adults will provide them with labels for every object. Some have referred to this interactive word-learning activity as the **original word game** (Brown, 1958). When playing the original word game with children, adults tend to provide labels that they would not provide to an adult asking the same question. For example, an adult unfamiliar with life in the countryside may point to a crow and ask *What's that?* The friend would likely say, *That's a crow.* If a child asked the same question, the adult is likely to say, *That's a bird.* Adults tend to provide children with the **basic level category** for objects, such as the label *bird* rather than the label for a particular type of bird (Brown, 1958, 1973).

Research also shows that infants who are too young to ask *What's that*? will use information from the social context when learning new words. Eighteen-month-olds, for example, will fail to learn new words if adults do not make it clear that the infant should pay attention and learn the new word (Baldwin et al., 1996). Baldwin and colleagues (1996) suggested that this is a sensible strategy on the part of infants, because half of parents' speaking during a day is not focused on the child and word-learning. Briganti and Cohen (2011) showed that 18-month-old infants learned words when viewing a picture of a person pointing at an object; 14-month-old infants did not. The implication is that infants' ability to use social cues in word learning develops after 14 months of age. For some individuals, the social context is more important in language learning than for others. Text Box 3.3 describes the life of Helen Keller, who learned language despite being blind and deaf from the age of 19 months. She was able to achieve so much because of one particularly dedicated teacher.

Text Box 3.3 Extraordinary Individuals: Helen Keller

▲ **Photo 3.5** Anne Sullivan with Helen soon after Sullivan's arrival in Alabama. Have you seen any of the films about Helen Keller's life?

Helen Keller (1880–1968) is best known for learning to speak, read, and write despite becoming blind and deaf at the age of 19 months. You may be familiar with her story, because her life served as the basis for the film *The Miracle Worker* (Penn, 1962; Tass, 2001). Helen was born in 1880 in Tuscumbia, Alabama. Her father, Arthur Keller, was a newspaper editor and had served as an army captain. When Helen was 6 years old, the family hired Anne Sullivan to be Helen's teacher. Sullivan was only 20 years old, partially blind herself, and had attended the Perkins Institute for the Blind in South Boston, Massachusetts. Her relationship with Helen continued to the time of her death in 1935. When Sullivan arrived in Tuscumbia in 1887, she attempted to teach Helen American Sign Language (ASL). She started by teaching her finger spelling. Initially, progress was slow because Helen did not understand what a sign was or what a word was. In her autobiography *A Story of My Life* (Keller, Shattuck, & Herrmann, 2004), she described the moment, when she was almost 7 years old, and suddenly realized what a word was. The day was life changing for her. On that particular day, Sullivan saw that Helen did not understand the lesson. In an attempt to add context to the words that were being taught, she took her to the well house and pumped water onto her hands and then finger spelled w-a-t-e-r in the palm of her hand. Keller described that event in her autobiography:

▲ **Photo 3.6** Helen when she was a young woman.

> Suddenly I felt a misty consciousness as of something forgotten—a thrill of returning thought; and somehow the mystery of language was revealed to me. I knew then that *w-a-t-e-r* meant the wonderful cool something that was flowing over my hand. (Keller et al., 2004, p. 16)

In May 1888, Helen began studying at the Perkins Institution for the Blind with Anne Sullivan by her side. In 1890, she embarked on her biggest challenge yet: learning to speak. For one who cannot hear, learning to speak is particularly challenging. She was taught by Sarah Fuller, the principal of Horace Mann School for the Deaf. Fuller allowed Helen to learn how to make speech sounds and syllables by using her hands to touch Fuller's face and mouth during speaking. Fuller also allowed Helen to explore the inside of Fuller's mouth during speaking, so that Helen could understand how the position of the lips, tongue, and throat changed during articulation. When Helen was 24 years old, she graduated from Radcliffe College in Cambridge, Massachusetts. She traveled the world, speaking about her life and advocating for the rights of the disabled. She was a prolific writer, publishing 12 books. In 1964, she received the Presidential Medal of Freedom from President Lyndon B. Johnson.

What Strategies Do Children Use When Learning New Words?

Whole Object Bias

When learning new words, children all over the world appear to make the same basic assumptions about words and their possible labels. In this sense, they are biased learners. For example, a child points to a giraffe and asks, *What's that?* If mom says, *It's a giraffe,* the child will assume that the word is the name for the whole object rather than a part of the object or some characteristics of the object (e.g., color). Imagine that a child sees a helicopter and asks, *What's that?* Dad says, *It's a helicopter.* The child is not likely to assume that the word refers to the rotating blade; rather, the word will be understood as referring to the whole object. This bias is referred to as the **whole object bias** when acquiring new words.

Mutual Exclusivity Principle

The second type of bias that children demonstrate is that they tend to assume that every object has one, and only one, label or name. This bias is called the **mutual exclusivity principle.** For example, if a child knows that the word for bucket is *bucket,* the child will assume that it is not referred to using another word. Markman and Wachtel (1988) demonstrated children's use of the mutual exclusivity principle in a series of experiments in which 3-year-olds were shown pairs of objects. One of the objects in the pair was a familiar object (e.g., banana, cow, spoon). The second object was unfamiliar (e.g., a pair of tongs). They were then told, Show me the plunk. *Plunk,* or another made-up word, was used. Children were significantly more likely to show the interviewer the unfamiliar object than the familiar one. Markman and Wachtel concluded that children reasoned that the plunk could not be the banana, because a banana is a banana; bananas cannot be called bananas and plunks.

Taxonomic Bias

The third bias that children demonstrate is that they tend to assume that a word refers to a type of an object or whole category rather than a specific example of the category. For example, children will assume the word *cat* does not refer to just Grandma's kitty but is a word that is used to describe all kitties. This has been referred to as the **taxonomy bias** (Markman & Hutchinson, 1984). Children as young as 18 months of age have been found to use these three strategies in acquiring new words (Markman, 1990).

How Do Children Differ in Word Learning?

Late Talkers

Some children begin using their first words much later than other children. The term ***late talker*** is used to describe a child who is 18 to 24 months of age or older who has a vocabulary of 50 words or fewer (Kelly, 1998). Studies that have followed late talkers to determine the extent that they continue to experience problems with language suggest that some late talkers will do as well as their same-age peers. A recent study by Rescorla (2009) assessed the language ability of 17-year-olds who had received a diagnosis of language delay

between the ages of 24 and 31 months. The results showed they performed in the normal range on language and reading tasks but had lower performance on vocabulary and verbal memory tasks as compared with peers from the same socioeconomic background.

Pronunciation Problems

Children may also struggle with the clear and precise production of phonemes for many years. Typical children may not master adultlike pronunciation until they are 8 years old (Ferguson, Menn, & Stoel-Gammon, 1992). Children may have difficulty producing /f/ and /v/ until 4 years of age (Sander, 1972). It is not until the age of 5 years that children can produce /r/, /l/, and /s/. The most difficult sounds to master are /θ/ as used in *thigh*; /ð/ as in *the*; and /ʒ/, as in *measure*. A small percentage of children may have difficulty producing some speech sounds even after age 8. Table 3.7 displays the average ages at which English phonemes are typically mastered. Most schools now provide speech therapy for such children. Although parents sometimes are reluctant to place their children in speech therapy out of fear that doing so will be stigmatizing, many adults who received speech therapy as children can report that the experience was not traumatizing and was helpful. My own experience with speech therapy occurred when I was about 9 years old and in the fourth grade. I received just a few lessons about how to pronounce /s/ and /f/. I vividly recall the day that I happened to notice how my speech therapist was placing her teeth on her lip to form the /f/ sound. My way of pronouncing the /f/ was not quite the same. Making that

Table 3.7 Average Ages at Which English Phonemes Are Typically Mastered

Age	Phonemes
Between 18 months and 3 years	/p/, /m/, /h/, /n/, /w/
Between 18 months and 4 years	/b/
Between 2 and 4 years	/k/, /g/, /d/
Between 2 and 6 years	/t/, /ŋ/
Between 2.5 and 4 years	/f/, /y/
Between 3 and 6 years	/r/, /l/
Between 3 and 8 years	/s/
Between 3.5 and 7 years	/tʃ/, /ʃ/
Between 4 and 7 years	/z/
Between 4.5 and 7 years	/θ/
Between 5 and 8 years	/ð/
Between 6 and 8.5 years	/ʒ/

Source: Based on Sander (1972).

connection was all that I needed. Soon, I was on my way of making clearer /f/ and /s/ sounds, and the speech therapy sessions ended.

Summary and Theoretical Implications

Infants are born with some extraordinary abilities, which position them well to begin to learn language. They are able to imitate facial expressions and to perceive the full range of speech sounds that exist in all the world's languages. The fact that infants appear equipped with useful abilities at birth is most consistent with nativist views of language development and least consistent with the view of the behaviorists that all knowledge, including language, is acquired through specific learning experiences.

By the end of the first year of life, infants lose the ability to distinguish the speech sounds that they do not hear regularly. Starting at 4 months, infants begin communicating with others, first through babbling, then by gesturing, and finally through producing words. Between 12 and 24 months, infants go from knowing few or no words to knowing 100 or more words. During this time of rapid vocabulary growth, infants rely on multiple strategies to learn new words, including asking adults for the names of objects. These facts are consistent with each of the major theories of language development and do not help us determine which theory of language development is better than the others. The behaviorist approach can explain the learning of vocabulary through imitating, classical conditioning, and operant conditioning. The social-interactionist approach can explain infants' learning of speech sounds and vocabulary through learning experiences that occur between caregivers and children, and the statistical learning approach can explain the learning of speech sounds and vocabulary through the infant relying on basic cognitive learning mechanisms that are not unique to language. Advocates of the generative approach have proposed that word-learning strategies may be innate, which can account for why language development proceeds relatively quickly for all children, regardless of the language that they are learning, but they have not yet provided detail regarding how innate mechanisms of language learning interact with the environment to bring about the changes that are observed in infants, ability to perceive and produce speech sounds.

Last, the chapter described how parents and caregivers play an important role in the health and well-being of infants; however, their role in language development is not yet clear. There are some cultures in which the adults do not routinely talk to preverbal children, yet those children acquire language normally. Recent laboratory studies suggest that the mere presence of a person in the room when language is being used may result in the infant paying greater attention to language, which may result in increased learning. The overall picture that language development does not critically depend on caregiver input is consistent with both the generative and statistical learning approaches and least consistent with the behaviorist approach, as parents are likely to be the largest source of language experience and language learning opportunities for the child. The results that show that language learning may be facilitated in infants by the presence of a person is consistent with the social-interactionist view; however, the evidence obtained so far suggests that social factors play less of a role in language development than advocates of this view claim.

KEY TERMS

auditory brainstem response (ABR)
autism
babbling
babbling drift
basic level category
canonical babbling
categorical perception
childhood amnesia
fast mapping
fricatives
grapheme
grapheme-to-phoneme correspondences
idiomorph
infant-directed speech
labial consonant
late talker
manner of articulation
mirror neurons
motherese
mutual exclusivity principle
original word game
otoacoustic emissions test (OAE)
overextension
phonological bootstrapping hypothesis
place of articulation
prosodic bootstrapping hypothesis
protowords
semantic memory
social smile
stop consonants
taxonomy bias
underextension
variegated babbling
vegetative sounds
voicing
voice-onset time
whole object bias
word spurt

REVIEW QUESTIONS

1. Describe infants' visual abilities at birth. How do they compare with the visual abilities of adults?
2. Describe infants' hearing abilities at birth. How is infant hearing tested in newborns?
3. What are newborn reflexes? How long are newborns able to produce the reflexes?
4. Discuss the evidence showing that memories of sounds are formed before birth.
5. How does an infant's ability to distinguish speech sounds change during the first year of life?
6. What evidence is there that the perceptual abilities of infants are influenced by the social environment?
7. What evidence is there that infants can form long-term memories?
8. At what ages do infants begin to recognize familiar words' speech sequences, prefer listening to familiar words, and learn to associate words with objects?
9. What are the different types of babbling that all children produce? In what order are they generally observed chronologically?

10. What evidence is there that babbling occurs in nonhuman species?
11. Who are the !Kung San people, and what do their child-rearing practices suggest about how children learn language?
12. Do deaf mothers who use sign language use motherese with their infants? What evidence is there that deaf mothers and infants use and experience motherese?
13. What were the challenges that Helen Keller faced in learning language?
14. What are the three stages in the development of communication?
15. Discuss infants' pointing behavior and the extent to which pointing is used for communication.
16. Describe the types of words that children typically learn first.
17. Explain when the word spurt occurs for typical, healthy children, and discuss possible causes for the word spurt.
18. What evidence is there that children use social cues in learning new words?
19. What biases do children exhibit in learning new words?
20. What is the original word game? Who plays it, and what role does it play in lexical development?
21. What is a late talker? What has research shown about the long-term outcomes for children who start out as late talkers?

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